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MISSOURI BOTANICAL GARDEN BULLETIN

VOLUME XVI

WITH 44 PLATES

1928

ST. LOUIS, MISSOURI

PUBLISHED MONTHLY EXCEPT JULY AND AUGUST,
BY THE BOARD OF TRUSTEES

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Missouri Botanical Garden Bulletin

Vol. XVI JANUARY, 1928 No. 1

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VIEW FROM MAIN GATE SHOWING NEW SOLID CONSTRUCTION OF ROOF OF LANTERN ON PALM HOUSE AND SIMILAR RECONSTRUCTION OVER CURVED PORTIONS OF THE CONSERVATORY ROOF.

Missouri Botanical Garden Bulletin

Vol. XVI JANUARY, 1928 No. 1

THIRTY-NINTH ANNUAL REPORT OF THE DIRECTOR

Gentlemen:

I have the honor to submit herewith the thirty-ninth annual report of the Director.

In the two immediately preceding annual reports attention was called to improvements and extensions which made these years notable ones in the development of the Garden. The year 1927 will be equally renowned but for quite a different reason, since such a succession of catastrophes visited the Garden as has never occurred in its previous history. The damage and destruction, affecting both greenhouses and plants, from the hailstorm of May 28 was recounted at length in the June number of the Garden BULLETIN and need not be related again. The wind storm early in May, together with the cyclone of September 29, destroyed or damaged between four and five hundred trees, and it will require the better part of a year to complete the necessary surgical work on those trees worth saving. The lapse of a half century at least will be necessary before some of the larger finer specimens can be replaced. On Christmas day the Garden, as well as the entire city of St. Louis, because of a peculiar combination of atmospheric conditions, was enveloped in a cloud of smoke such as has never before been experienced. At various times attention has been called to the destructive action of the poisons in the air due to the incomplete combustion of coal, and it has been recognized for a long time that plants could not be grown at the Garden as they could outside of the city. Never before, however, has there been such a striking demonstration at the

Garden of the effect of smoke on plants, and, because of the widespread interest in the subject and studies which are being carried on throughout the world on this phenomenon, a rather careful list has been prepared demonstrating the susceptibility or powers of resistance of a considerable number of plants to the action of smoke. While, of course, it is impossible at this time to state what the latent effect of the smoke cloud may be the following list indicates the immediate effect and will give some idea of the seriousness of the problem to an institution like the Garden. The damage manifested itself within twenty-four hours, and in some plants appeared either as burnings on the margins of the leaves or as irregular splotches producing a mosaic effect. Other plants were either completely defoliated or later lost the percentage of leaves indicated.

Those showing immediate burnings with the percentage of leaves destroyed were:

Water hyacinth, 80%
Gerbera, 10%
Primula obconica, 100%
Jasminum, tips of leaves
Hydrangea, margins and partial defoliation
Ficus Carica, 95%
Adiantum, 50%
Nephrolepis bostoniensis, 50%
Nephrolepis pectinata, total loss
Pteris, 50%
Primula malacoides, 25%
Tropical water-lilies, 80%
Victoria regia, 90%, possibly total loss.
Geranium, 30%
Cinerai ia, 50%
Stevia, 100%
Erlangea, 100%
Tetradenia, flowers, later 100%
Pomegranate, 50%
Cattleya Trianae, all flower buds within sheaths
Myosotis, 15%
Epiphyllum truncatum, open flowers only

The following collection of medicinal plants which was in one of the greenhouses showed immediate burning and consequent destruction of 50 per cent of the leaves, with the exception of hound's-tongue which was completely destroyed:

Chicory
Tansy
Lemon balm
Caraway
Belladonna
Digitalis
Beard-tongue
Sweet basil
Hyssop
Red pepper
Plantain
Sage
Chamomile
Alum root
Jacob's ladder
Hound's-tongue
Catnip
Lobelia
Quinine

EXAMPLE OF INJURY TO SPECIMEN TREE (GINKGO BILOBA) BY CYCLONE.

BURNING EFFECT OF SMOKE CLOUD OF DECEMBER 25 ON CINERARIA PLANT AND LEAVES OF VICTORIA REGIA.

The following showed immediate partial defoliation without obvious burning:

Acalypha, 45%
Begonia, 80%
Coleus, 30%
Eucalyptus, 50%
Eupatorium glabratum, 80%.
Mimosa, 95%
Tomatoes, 25%

Those partially defoliated within the following week, but showing no immediate effect were:

Crotons, 40%
Citrus, 30%
Jerusalem cherry, 50%
Poinciana regia, total
Poinsettia, 80%
Dracaena, 75%
Sterculia, 95% (trees 30 ft. high)
Duranta, 50%
Brunfelsia, 90%
Strobilanthes, 10%
Eranthemum, 10%
Alternanthera, 75%
Pycnostachys Dawei, 30%
Asclepias Curassavica, 10%
Saintpaulia ionantha, 25%
Stocks, 50%
Geraniums, 25%
Pelargonium, 25%
Polypodium aureum, 40%
Polypodium Phyllitidis, 90%.
Platycerium, 30%
Aristolochia gigas, 30%
Carica Papaya, 75%
Ficus species, 30%

All the plants in the economic house lost, within four or five days, at least thirty per cent of their leaves, and the few plants in the succulent house which possess leaves were defoliated to the extent indicated below:

Pereskia Bleo, 70%
Pereskia aculeata, 30%
Pereskia Godseffiana, 80%
Euphorbia splendens, 100%
Crassula, 10%

Plate 3 graphically illustrates the immediate burning effect, the leaves of *Victoria regia* showing remarkably well the action of smoke on their tissues. In this connection, attention should be called to the striking improvement in the entire orchid collection since it was removed from the city garden to the Gray Summit Extension. It is probable that the results are not entirely due to the more favorable atmosphere, since there is considerably more sunshine at Gray Summit than in the city and nothing but rain-water is used on these plants. The combination of these three favorable factors has resulted in an improvement in the orchid collection which is little short of phenomenal. Those who were familiar with the plants when growing in the city are scarcely able to believe that those now at Gray Summit are the same ones. Plate 4 shows the growth

attained while in the city contrasted with that which has taken place in twelve months at their new location.

Construction and Repair Work.—Because of the destruction by the hailstorm of eighty per cent of the glass in the greenhouses it was necessary to remove all of the undamaged glass and reglaze every house. Advantage was taken of the opportunity to repaint all of the steel superstructure and much of the interior woodwork and to make all necessary repairs to the roofs at the same time. By substituting a heavier glass which permitted the transmission of more light than the ground glass formerly in use, it was possible to eliminate practically all of the bent glass on the curves of the roof, replacing it with wooden sheathing and composition shingles. The lantern on top of the palm house, formerly of glass, was likewise equipped in this manner. The result has been most satisfactory. Not only is the lighting better but the tight roof over a part of the houses, together with the use of a newly devised bronze clip, has thus far prevented all slipping of glass and has resulted in a very considerable saving of heat. On two occasions with an outside temperature of zero and an extremely high wind, the large conservatories were kept twelve degrees higher than was ever possible under similar conditions with the old type of roof construction.

The hail not only damaged the glass houses but also practically every roof in the Garden, and the slate and copper roofs on the museum, old residence, Cleveland Avenue house, and administration building have had to be extensively repaired. Another very considerable item which it seemed advisable to undertake at the same time was replacing the old wooden cornice around that portion of the administration building which was formerly Mr. Shaw's city residence. This building, it will be recalled, was removed from the corner of Seventh and Locust streets to its present site in 1890, and the overhanging cornice which was of an elaborate pattern had decayed to such an extent that it was becoming dangerous. This has been replaced by a terra-cotta cornice, following in general the design of the old wooden cornice and being an exact replica of the terra-cotta cornice at the other end of the building. The copper guttering was likewise

PORTIONS OF ORCHID PLANT GROWN AT GRAY SUMMIT (INDICATED BY ARROW) CONTRASTED WITH SMALLER PARTS DEVELOPED AT CITY GARDEN.

MANAGER'S HOUSE AT TROPICAL STATION, BALBOA, CANAL ZONE.

SUPERINTENDENT'S HOUSE AT SOUTHWEST CORNER OF GARDEN.

replaced with new copper. While the cost of all these repairs has imposed a heavy burden upon the income of the Garden, it must be confessed that the improvements made, particularly in the greenhouses, offset to a certain extent the original damage done. It can be safely stated that the physical condition of the buildings at the Garden was never so satisfactory as at the close of the year 1927.

Other items of repairs and construction include the repainting of all the outside woodwork of the museum, Cleveland Avenue house, and the old residence, as well as the interior walls of the rooms at the main entrance; the building of eight large cement vases at the corners of the water-lily pools; the installation of a hot-water heating system at the main entrance; and various other items which, were it not for the extraordinary reconstruction incident to the hail storm, would seem of major importance.

The desirability of having a house located near the southwest corner of the Garden in the vicinity of the lake, as an effective means of policing this region, has been recognized for some time. Advantage was accordingly taken of an opportunity to buy from the City of St. Louis one of the brick houses which stood upon the Payne Tract, recently acquired by the city for incorporation in Tower Grove Park. This house was successfully moved into the Garden and is now occupied by the Superintendent.

Flower Shows.—Because of the condition of the road incident to the construction of the concrete highway to the Gray Summit Extension, it was impossible to transport by truck the orchid plants necessary for the staging of the regular January orchid show. Instead, the experiment was tried of cutting the blossoms and displaying them behind glass. The stem of each flower was inserted in a tube containing water and the protection of a glass case prolonged the life of the blossoms, but the effect obtained was not as satisfactory as when the whole plant was exhibited. The chief advantage of this arrangement was to emphasize the great variation in blossoms of the same species of orchid, and for those who were familiar with the many varieties this proved of considerable interest. For the general public, however, nothing is so satisfactory as the display of blooming plants, and with

the completion of the concrete road there is no reason why the old type of show should not be restored.

The orchid show was followed by a display of cinerarias. On March 23-28, for the first time the commercial florists and growers of St. Louis and vicinity held a show in the floral display house. There was a large attendance, and those concerned were gratified with the results. Great pains were taken to construct elaborate booths and display the best material, and the result was a great credit to the efforts of the St. Louis Flower Show Association, Inc., the St. Louis Florist Club, Inc., the Retail Florists' Association of St. Louis, Inc., and the St. Louis Allied Florists' Association, under whose auspices the show was held. It is believed that the success of this show will warrant its continuation during the coming years.

In April a mixed display of roses, calceolarias, begonias, etc., indoors, together with daffodils and tulips out of doors, made the Garden very attractive. On May 21 and 22 the eighth Annual Amateur Flower Show, under the auspices of the Garden Club of St. Louis, was held, and in October a dahlia show, which had been omitted for two years because of unfavorable growing weather, was again a feature, both amateur and commercial growers competing.

The usual bouquet of orchids was presented to the Veiled Prophet Queen in October, to be displayed the following day at the Garden, and in November the annual chrysanthemum show was staged. Many of the best plants had been damaged by falling glass during the hailstorm, so that the number of single-stem varieties was considerably less than usual. However, the bush plants grown outside during the summer were in excellent condition, and more than fifty thousand visitors attended the show.

The December display consisted of poinsettias, both the pink and white varieties as well as the standard reds. Considerable attention was attracted by the new double reds, which were shown in quantity for the first time and which are to be found at the Garden only.

New features deserving special mention in the out-of-doors plantations are the medicinal garden, noticed at length in the September and October numbers of the BULLETIN; the

sample back yards constructed during the time of the Garden Club show, contrasting a neglected back yard with one beautified by simple and inexpensive care and planting; and a considerable increase in the test plots of various strains of bent grass, details of which were given in the November number of the BULLETIN.

Gray Summit Extension.—A large amount of grading and other preliminary work incident to the construction of permanent roadways has been accomplished at the Gray Summit Extension during the past year. About nine acres of land immediately surrounding the lake where the future pinetum is to be established have been brought to grade and planted with grass seed. Because of the contour of this part of the property a great deal of earth had to be moved, about 8500 loads being handled. Nearly two miles of eighteen-foot roadway have been brought to final grade, and additional roads have been rough-graded. The first layer of gravel, obtained from our own gravel bed, has been applied to a considerable portion of this roadway. Outcroppings of rock at different places necessitated drilling and blasting, and, while much of this rock is too soft to be of use, some of it is valuable for roadbuilding and also will be used to construct a low stone wall along Manchester Road. The high bank along this boundary of the property has been leveled, the telephone poles lowered, and everything is now in readiness for the improvement of that part of the Extension abutting on the main highway. The road to the boiler house and coal-storage bin has been completed, including the installation of a twelve-inch drain with the necessary catch basins.

The old brick house which may be regarded as something of a landmark, since it was constructed over fifty years ago from brick made on the place, is being repaired and renovated for use as an administration building. The porch on the south side of the house was removed and a new one erected which will serve as a more convenient entrance to the house. The cellar was enlarged for the installation of the heating plant which is now in operation, a bathroom built on the second floor, and a lavatory on the first floor. The water supply has been brought from the well in the

garage near the greenhouses, for which purpose a run of 2000 feet of 2-inch water pipe was laid. Various sheds in the vicinity of the brick house have been removed, and a start made toward improving the road to the house.

One of the frame houses on the place has been put into livable condition for the farmer who formerly occupied the brick house. Besides digging a cellar in which to install a heating plant, a bathroom was built in, a combined pump house and garage constructed, and much general repair work and painting attended to. A new pump house has also been built at the cottage occupied by the engineer.

A demonstration apple orchard covering an area of seventeen acres was terraced and graded, and about six hundred trees are already established. This orchard includes only four or five of the best commercial varieties, but in addition a variety orchard to occupy about the same area is being established, where it is expected that every kind of apple that can be secured will be grown. These orchards are designed as demonstrations of what can be done with apples in this part of the country when the orchard is carefully planned and scientifically cared for. As different orcharding practices are undertaken notice will be given to surrounding farmers, and opportunity to observe both the operations and results will be afforded. The growing of farm crops on the Extension has been practically discontinued, as it is desirable to get what was formerly farm land into grass as soon as possible. Only the grain actually needed for the small amount of stock on the place is being raised.

In addition to the larger trees and shrubs which have been established in the nursery in the past few years, there are now developing thousands of seedlings, grown from seed obtained from this country, as well as China, Austria, and other foreign countries. The majority, however, are evergreens not previously grown in the United States. These will be tested and eventually those which survive will be incorporated in the pinetum.

In the greenhouses a considerable amount of painting and general repair work has been attended to. Additional heating pipes were installed at the north end of six of the houses where difficulty had been experienced in maintaining the

proper temperature. A considerable number of the slat shades have been painted, and wherever necessary outside painting has also been done. The condition of the orchids in these houses is excellent, the growth, because of the removal from the city, previously referred to, far exceeding anything anticipated.

Most satisfactory progress has been made in the growing of orchids from seed. A great number of crosses were made, although it was anticipated that but a small percentage would be successful. Out of some 285 attempts to hybridize these plants mature seed pods were collected from but 57. Some of the outstanding crosses of exceptional value which have been successfully made are as follows:

YELLOW HYBRID FORMS:

Cattleya Triumphans X *Laeliocattleya Nelthorpe Beauclerk.*
Laeliocattleya Nelthorpe Beauclerk X *Laeliocattleya The Baroness, F. C. C. R. H. S.*
Laeliocattleya Moonbeam X *Laeliocattleya Haroldiana*, variety *Bronze King.*

DEEP MAUVE HYBRID FORMS WITH LARGE FIMBRIATED LABELLUMS:

Brassocattleya Penelope X *Laeliocattleya Serbia.*
Laeliocattleya Jacquinette X *Brassocattleya Jupiter.*

DELICATELY COLORED HYBRID FORMS WITH COLORFUL LABELLUMS:

Brassocattleya Albatross X *Cattleya Clotho*, variety *General Pershing.*
Cattleya amabilis X *Brassocattleya Oberon.*

ALBINO HYBRID FORMS WITH FIMBRIATED LABELLUMS:

Brassocattleya Albion X *Cattleya Gildinii alba.*
Cattleya gigas alba X *Cattleya Gildinii alba.*

Seeds of the following genera have been successfully germinated:

Cattleya
Brassocattleya
Laeliocattleya
Cymbidium
Dendrobium
Miltonia
Sobralia
Stanhopea
Epidendrum

The number of seedlings old enough to be transplanted to one-inch pots is approximately 8000, while the number of seedlings in earlier stages of growth approximates 30,000.

In addition, a considerable number of experiments have been carried on in the laboratory, calculated to demonstrate the effect of sugars and other nutrients on the growth of seedlings.

Tropical Station. — The plot of ground allotted by the Canal Zone Government for the new Tropical Station was cleared and ready for the reception of the orchids early in the year. Through the interest and diligence of Mr. C. W. Powell, the resident manager, the necessary staging, sheds, etc., together with a considerable amount of planting, was rapidly completed and within a short time the garden began to attract a number of visitors. The local paper, published in the Canal Zone, commenting on the completion of the orchid garden, remarked: "Formerly, visitors when they came to the Zone were asked if they had seen the 'Big Ditch'; now the first inquiry is 'Have you been to the new Tropical Station of the Missouri Botanical Garden?'" During the early part of the year, in addition to increasing to a minor extent the collection of Panamanian orchids, there were received by exchange plants from the Royal Botanic Gardens, Kew, England, the Glasnevin Gardens, Dublin, Ireland, as well as from Sanders of St. Albans, England, the Chandra Nursery of Sikkim, Bengal, and from Boutan State, India, from Hongkong, and the Philippines. The Canal Zone granted the use of a plot of ground immediately across the street from the Garden for a manager's house, and this house, of concrete and wood, was completed at a cost to the Garden of about $9000. Mr. Powell occupied it on the first of July, but unfortunately was destined to enjoy it but a brief six weeks, he having died suddenly on August 18. Mr. Powell was known throughout the world as a collector, student and lover of orchids and had many friends and admirers among those who either had met him personally or knew him through his world-wide correspondence. Details of his work, together with a description of his gift of orchids to the Garden, have been frequently referred to in preceding numbers of the BULLETIN. All that need be added here is to record the high esteem in which Mr. Powell was held by all of those who knew him at the Garden and to acknowledge again the indebtedness of the

Garden to him for making it possible to establish on the Canal Zone a tropical station, with his orchid collection as a nucleus.

Mr. A. A. Hunter, who had frequently accompanied Mr. Powell on his collecting trips and who is thoroughly familiar with the Panamanian orchids, has been appointed Manager of the Tropical Station to succeed Mr. Powell. In March, Mr. Pring, Horticulturist to the Garden, made a trip to the Canal Zone in order to discuss with Mr. Powell the future development of the Tropical Station and also to attempt a collecting trip in the Chiriqui region for the purpose of adding to the Garden collection of Panamanian orchids. This trip was successfully made in company with Mr. Hunter, and a full account of the results was published in the May number of the BULLETIN. The St. Louis *Star*, commenting on this trip, published the following editorial:

CHRISTOPHER COLUMBUS UP-TO-DATE.

Marco Polo was responsible for the belief there were men with one eye in the middle of their forehead, others with the heads of dogs, and still other men with tails, in the neighborhood of Cipango and the Asiatic coast. Christopher Columbus prowled along what he thought was that coast in search of these monsters, but it was the coast of a new continent, Nicaragua and Panama, and the men he sent into the jungles failed to find what they were looking for.

Almost four centuries later a St. Louis explorer of a different type crawls through these jungles looking for—not one-eyed men, but the Odontoglossum Powelli. The Powelli is an orchid, and specimens of it are wanted for the Missouri Botanical Garden's collection. It is to the vegetable kingdom what Marco Polo's freaks would have been to the animal kingdom, if they had existed. The St. Louisan, differing from Columbus, found what he sought—seventy-five individual specimens of Powelli, whereas only one living specimen was known to exist.

Who says adventure and romance died with the twentieth century? Adventure and romance exist in whatever is being sought, whether it is orchids, germs, a graceful line in a statue, or a new shade in a window curtain fabric.

Annual Bequests.—The annual flower sermon, provided for in Henry Shaw's will, to "commemorate the Goodness of God as revealed in flowers," was preached on Sunday, May 15, at Christ Church Cathedral, by the Rev. Frank Du Moulin, D. D., of Philadelphia.

The bequest of Mr. Shaw providing for prizes for flower

shows was used in part for the purchase of a large silver cup to be awarded as a sweepstakes prize to the retail exhibitor gaining most points at the St. Louis Spring Flower Show. The winner in 1927 was Joseph Witek. The cup must be won three times to become the permanent property of one firm.

ATTENDANCE FOR THE YEAR 1927.

	Week-days	Sundays
January	3,642	5,754
February	10,715	10,757
March	14,055	18,411
April	10,222	15,350
May	10,892	14,357
June	15,162	10,919
July	15,914	10,717
August	20,755	10,433
September	13,799	9,198
October	11,120	9,296
November	22,375	27,866
December	5,755	7,108
	154,426	150,166
		154,426
Total		304,592

RESEARCH AND INSTRUCTION

The completion of the Charles Rebstock Biology Hall at Washington University has made possible the reorganization of the work formerly carried on in the graduate laboratory at the Garden, an arrangement which promises to be most satisfactory. The new laboratory, because of its modern equipment and the space available for various types of work, has made it possible to transfer practically all of the investigations in physiology to the University. Undergraduate courses in physiology and economic botany were offered for the first time this fall, and graduate students majoring in these branches of botany will do their work in the new laboratory in the future. An adequate laboratory for mycology is likewise available, and from now on this work will be conducted for the most part at the University rather than at the Garden.

Dr. B. M. Duggar, Physiologist to the Garden and Professor of Plant Physiology in Washington University, resigned,

September 1, to accept a position at the University of Wisconsin, and Dr. E. S. Reynolds was appointed Physiologist to the Garden and Associate Professor of Plant Physiology in Washington University.

Professor W. W. Lepeschkin, formerly Professor of Plant Physiology at the University of Kasan, Russia, now Professor and Dean of the Department of Natural Sciences of the Russian Peoples University in Prague, who is widely known throughout the botanical world because of his books and various published articles on plant physiology, was appointed Visiting Physiologist to the Garden and Visiting Professor of Plant Physiology in Washington University for the first part of the college year. Professor Lepeschkin gave a course on the "Physiological Processes of Plants from the Physico-Chemical Standpoint," in addition to conferences held with the graduate students. He delivered the address for the botanists at the dedication of Rebstock Biology Hall.

Dr. J. M. Greenman, Curator of the Herbarium and Professor of Botany in Washington University, has been placed in charge of the graduate students.

Dr. David H. Linder, who was appointed Mycologist and Instructor in Botany in 1926, but who was granted a leave of absence to accompany the Harvard tropical disease expedition to Africa, returned this fall and took up his duties at the Garden and University.

As was noted in the September BULLETIN, the Garden has been able, through the generosity of some of its friends, to establish a motion-picture department, and for the last six months of the year employed Mr. A. C. Pillsbury as operator. An adequate studio, including dark room and printing room, was fitted up in the basement of the laboratory building, and four cameras have been in operation here for the past few months. The application of this work to fundamental botanical research, particularly in the recording on the movie film plant activities observed under the microscope, is becoming more and more important. It is hoped that within a short time the Garden may be able to obtain improved apparatus for the purpose of carrying on more intensively this work which is closely associated not only with research but with elementary instruction in botany.

Investigations in the various aspects of botany have been continued through the year along much the same lines as in the past, the particular fields being those of taxonomy, physiology and mycology. The results of the work accomplished continue to appear in the ANNALS, the quarterly journal containing scientific contributions by members of the staff and graduate students of the Henry Shaw School of Botany.

Published Articles.—During the past year the four numbers of Volume XIV of the ANNALS have been issued. The various articles are listed below:

Larsen, Esther L. "A Revision of the Genus Townsendia." Vol. XIV, pp. 1-46.

Epling, Carl C. "Studies on South American Labiatae. III. Synopsis of the Genus Satureia." Vol. XIV, pp. 47-86.

Overholts, L. O. "A Monograph of the Genus Pholiota in the United States." Vol. XIV, pp. 87-210.

Payson, E. B. "A Monograph of the Section Oreocarya of Cryptantha." Vol. XIV, pp. 211-358.

Neal, David C. "Cotton Wilt: A Pathological and Physiological Investigation." Vol. XIV, pp. 359-424.

Overholts, L. O. "Species of Cercospora on Smilax in the United States." Vol. XIV, pp. 425-432.

Besides the above, the following articles by members of the scientific and Garden staff have appeared in journals not supported by the Garden:

Jensen, L. P. "Fascinating Old Books on Gardening." Gardeners' Chronicle of America. February, 1927.

Jensen, L. P. "Useful and Interesting Publications." Parks and Recreation. January-February, 1927.

Anderson, Edgar. "Iris versicolor in Northern Ontario." American Iris Society Bulletin. March, 1927.

Moore, George T. "Smoke." Scientific American. May, 1927.

Jensen, L. P. "A Retrospective View on Parks" and "More State Parks for Missouri." Parks and Recreation. March-April, 1927.

Scientific and Popular Lectures.—B. M. Duggar, January, before the seminar of the department of botany, University

of Cincinnati, "Some Experimental Aspects of the Mosaic Disease Problem."

G. H. Pring, January 5, before the St. Louis Association of Gardeners, and February 10, before the Disabled American Veterans, "Smoke."

G. H. Pring, January 13, before the Elks Club of Belleville, Illinois, January 14, before the Narcissus Club, February 2, at Michigan Agricultural College, East Lansing, February 8, before the Principia School, St. Louis, "Collecting Orchids in the Andes Mountains."

Hermann von Schrenk, February 2, before the Home Garden Club of Webster Groves, "Trees of the Pacific Coast."

Hermann von Schrenk, February 14, before the Kirkwood Garden Club, "Trees."

B. M. Duggar, March 1, before the Washington University Association, "The Significance of Certain Ultra-Microscopic Virus Studies in Relation to the Origin of Life."

Paul A. Kohl, March 8, before the Carondelet Improvement Association, "Plants, Shrubbery, Trees, Care of Yards, etc."

G. H. Pring, March 9, over Radio Station NBA, Balboa, Canal Zone, "The Orchid Collection at the Missouri Botanical Garden and Its Relation to the Tropical Station at Balboa."

Paul A. Kohl, March 15, before the Garden Club of St. Louis, "Plant Propagation."

George T. Moore, March 16, before the science section of the Wednesday Club, "Some of the Experimental Work Conducted by the Missouri Botanical Garden."

George T. Moore, March 24, before the Women's Round Table Club, "Sensations in Plants."

George T. Moore, March 31, before the garden department of the Springfield Art Association, Springfield, Illinois, "The Evolution of Gardens."

George T. Moore, April 6, before the St. Louis chapter of Phi Sigma, "Some Plant Reactions."

B. M. Duggar, April 7, under the auspices of Gamma Sigma Delta and Sigma Xi, at the University of Missouri, "Methods of Fundamental Research in Certain Virus Diseases"; and "The Significance of Some Ultra-Microscopic Studies in Relation to the Nature and Origin of Life."

Paul A. Kohl, April 8, before the Alton Women's Council, "Plant Propagation."

George T. Moore, April 10, before the Laymen's Guild of the Church of the Messiah, "The Plant Commonwealth."

Hermann von Schrenk, April 27, before the Garden Club of East Orange, New Jersey, "Gardens."

George T. Moore, April 29, at the bicentenary celebration of the American Philosophical Society, Philadelphia, "The New Tropical Station of the Missouri Botanical Garden, at Balboa, Canal Zone."

J. M. Greenman, April 29, before the Illinois Academy of Science, "Early Botanical Collections in Illinois."

George H. Pring, May 2, before the Parkview Improvement Association, "Effect of Smoke Upon Plants."

George H. Pring, May 3, before the Men's Club of the Clifton Heights Presbyterian Church, May 5, before the St. Louis Architectural Club, and May 11, before the Women's Club of Belleville, Illinois, "Collecting Orchids in the Chiriqui Region of Panama."

Paul A. Kohl, May 14, before the Matrons' Literary Club of Madison, at Edwardsville, Illinois, "Iris and Roses."

Elinor Alberts, June 9, before the St. Louis Florists, "Growing Orchids from Seeds."

George T. Moore, June 9, before the graduating class of the St. Louis Country Day School, "The Evidence of Experience."

George H. Pring, July 26-27, before the Chautauqua, Piasa, Illinois, "Collecting Orchids in the Andes Mountains," and "Wild Flowers."

George H. Pring, August 4, before the Rotary Club of Edwardsville, Illinois, "Collecting Orchids in Panama."

George T. Moore, October 13, before the First National Fuels Meeting, "The Measurement of Atmospheric Smoke Pollution Visible and Invisible."

George T. Moore, October 18, before the Collinsville Study Club, "Sensations in Plants."

Edgar Anderson, October 25, before the Peoria Garden Club, Peoria, Illinois, "Flower Families."

Edgar Anderson, November 4, before the Botany Club of Soldan High School, "Blue Flags."

W. W. Lepeschkin, November 21, before the Washington University Association, "Physico-Chemical Causes of Death."

George H. Pring, November 21, before the botany section of the Webster Groves Nature Study Society, "Collecting Orchids in South America."

J. M. Greenman, December 28, before the systematic section of the Botanical Society of America, Nashville, "A New Senecio from Western Virginia and Eastern Tennessee."

Mildred E. Mathias, December 28, before the systematic section of the Botanical Society of America, Nashville, "A Taxonomic and Geographical Study of Glehnia, a Genus of Umbelliferae."

Robert E. Woodson, Jr., December 28, before the systematic section of the Botanical Society of America, Nashville, "A New Genus of Berberidaceae."

Edgar Anderson, December 29, before the general section of the Botanical Society of America, Nashville, "The Problem of Species."

Edgar Anderson, December 30, before the American Nature Study Society, Nashville, "A Naturalist's Pilgrimage to Canterbury."

School for Gardening.—For a number of years there has been a demand from certain groups in St. Louis for instruction along gardening lines but not calling for the time or range of work required in the regular curriculum of the school. It is a question how far the school can go in meeting such demands and still maintain the schedule in the three years' course as it has been offered in recent years. However, in order to test to a certain extent the desirability of a change in policy, the facilities of the school were this fall offered to two groups of students—one, a class of twenty-two made up of cemetery superintendents, and the other, a class of twelve young women from the St. Louis School of Occupational Therapy. These two classes have spent from one to two afternoons a week at the Garden, studying such phases of landscape and gardening work as were deemed most helpful in their respective professions. The apparent success of such classes would seem to indicate that it may be worth while to consider offering additional courses in definite phases of horticulture which can be completed in a compara-

tively short time and will appeal to the special needs of those interested.

Of the students enrolled regularly for the three years' course, Mr. Rist has transferred to Washington University as a candidate for the B. A. degree, and Mr. Layton has now registered in the School of Architecture, Washington University. Mr. Waldbart and Mr. Gilmour continue their work at the Garden.

HERBARIUM

The year 1927 has been one of marked progress in the herbarium. The amount of new material acquired has been considerably in excess of that received during the previous year; and the greater part of it has been mounted and incorporated in the organized herbarium. The new steel cases and special containers which were installed in 1926 have made it possible to expand a large portion of the herbarium and likewise to rearrange the mounted specimens in a manner effecting greater convenience for reference and study.

Attention has been centered chiefly, as in previous years, on the flora of the southwestern part of the United States; although great care has been exercised in building up the collection as a whole, so that the Garden may have eventually a well-rounded herbarium illustrative of the world's flora. With this aim in view several important exotic collections have been acquired during the year 1927.

New Accessions.—Some of the more noteworthy collections obtained during the year are the following: Dr. E. Anderson, 56 plants of Ontario, Canada, and 33 plants of England; Arnold Arboretum of Harvard University, 1677 plants of North America, collected by E. J. Palmer; Robert Bebb, 41 plants of the Rocky Mountain National Park, Colorado; Botanischer Garten und Museum, Berlin, Germany, 150 plants of Bolivia, collected by J. Steinbach; Jardin et Musée Botaniques, Université de Cluj, by Professor Al. Borza, 100 plants of Roumania; W. E. Broadway, 91 plants of Trinidad, B. W. I.; Mrs. Agnes Chase, 350 plants of Brazil; Hon. Joseph R. Churchill, 217 plants of North America; Conservatoire et Jardin Botaniques, Genève, Switzerland, 560 plants of Savoy, France, collected by E. Perrier de la Bathie; Miss

Edna L. Davis, 1634 plants of North Carolina, South Carolina, and Georgia, collected by the late Rev. John Davis; Professor J. A. Drushel, 128 plants of North America; D. Lewis Dutton, 100 plants of Connecticut; Dr. Carl C. Epling, 328 plants, mostly from Idaho; J. M. Grant, 715 fungi of Washington; Dr. J. M. Greenman, 275 plants of Missouri; A. A. Heller, 400 plants of North America; Dr. G. Herter, 436 plants of Uruguay; John M. Holzinger, 50 North American mosses; Institut Botanique de l'Universitè Masaryk de Brno, by Dr. Joseph Podpêra, 200 plants of Czechoslovakia; Iowa State College, by Professor L. H. Pammel, 498 plants of North America; J. H. Kellogg, 494 plants of Missouri; Joseph Kramer, 205 plants of Nebraska; Miss Esther L. Larsen, 583 plants, mostly from Montana; Miss Mildred E. Mathias, 360 plants, mostly of Vermont and Missouri; G. K. Merrill, 50 lichens of North America and the West Indies; Dr. Hjalmar Möller, 136 plants of Brazil, collected by P. Dusén; Naturhistoriska Riksmuseet, Stockholm, 400 plants of Sweden; New York Botanical Garden, 133 plants of South America; Rev. Hugh O'Neill, 237 plants of Florida; Dr. L. O. Overholts, 71 fungi of Missouri; E. J. Palmer, 332 plants of Missouri; M. P. Porsild, 110 plants of Greenland; F. C. Seymour, 100 plants of Massachusetts; Smithsonian Institution, Washington, 341 plants of Haiti; Dr. F. L. Stevens, 740 fungi of South America, Central America, Hawaii, etc.; H. Sydow, 200 fungi; U. S. National Museum, 599 plants, chiefly from North America; U. S. Dept. of Agriculture, 27 fungi of Alabama; University of California, 125 plants of California; University of Montreal, by Bro. Marie-Victorin, 338 plants of Quebec, Canada; D. D. Wagner, 40 fungi of New York; Dr. E. Werdermann, 469 plants of Chile; P. Wilson, 1,000 fungi of North America; Robert E. Woodson, Jr., 933 plants of North America. Numerous smaller collections have been received from correspondents and friends of the Garden, which have been recorded in current numbers of the BULLETIN.

Mounting and Distribution.—The mounting and distribution of specimens have continued throughout the year; and

over 12,000 specimens have been incorporated in the organized herbarium during this period.

Field Work.—A limited amount of field work has been carried on during the year, particularly in Missouri and Illinois. This work has resulted in supplementing our representation of the local flora, and in furnishing duplicates for exchange.

Exchanges.—The number of duplicate specimens sent to institutions and correspondents with whom the Garden has long maintained exchanges is considerably larger than in 1926. Many undistributed duplicates, however, are still on hand awaiting to be sorted into sets and labelled properly before being sent to correspondents.

Use of the Herbarium by Outside Botanists, and Loans.—It is gratifying to state that each year there is an increasing number of botanists from various parts of the country, who visit the Garden to consult the herbarium and library. There has been, as in previous years, an interchange of herbarium material for the use of specialists and advanced graduate students engaged in taxonomic research and monographic work. Such interchange of herbarium specimens, when exercised judiciously, results in a mutual advantage to both parties concerned.

Statistical Summary (For the year ending December 31, 1927).

Number of specimens received on new accessions:

By purchase.....	9,782	
By gift	2,269	
By exchange	3,556	
By field work.....	692	
	16,229	valued at $1,629.90
Number of specimens mounted and incorporated	12,051	valued at 2,410.20
Number of specimens discarded from the herbarium	63	without value
Number of specimens in organized herbarium	941,579	valued at $150,233.40
Number of specimens in unorganized herbarium	94,874	valued at 8,144.06

Wood specimens, etc., supplementing the herbarium	valued at	$280.00
Microscopic slides	valued at	410.00
Total valuation		$159,067.46

LIBRARY

The Missouri Botanical Garden library is primarily for the use of the students and staff of the Shaw School of Botany, who are allowed access to the shelves and the use of the books as long as they need them. During 1927 over 2,000 books were in circulation at the Garden. The public may use the library for reference purposes, but no books are loaned outside the building except as an interlibrary loan. One hundred and ten books were loaned to 23 libraries during the last year. No record of the books consulted by the public is kept, but the use of the library for reference purposes is constantly increasing. To cite a few instances: several requests for colored illustrations of certain plants have come from advertisers; a real-estate dealer used the government soil maps to help sell a farm in the Ozarks; a group of men interested in commercial fibers have compiled from the library a bibliography on the subject; druggists have often asked the library to help them check scientific names of plants; and students from near-by institutions have made numerous trips to the Garden to consult the pre-Linnean and other early books on botany and related subjects.

With the transfer of the work in plant physiology to Washington University a majority of the books bearing on that branch of botany were deposited in the library of Rebstock Hall, as a loan. Considerable time of the library staff was devoted to checking over and compiling lists of these books and making the necessary notations in the library records.

A much-needed improvement is the new reading room, the room formerly used as the physiologist's office. The old reading room was never adequate, since it was used also as a waiting-room, folio room, current periodical room, and cataloguing room. In the new reading room special pigeon-holes for the current periodicals were built around the walls, and the most used publications placed on racks in the middle of the room. The dictionaries, encyclopedias, and other reference books are

also assembled here. The room is available for students and others wishing a quiet place in which to review the current botanical literature.

The great need of the library at present is space. In some sections room can not be found on the shelf for a new book, and it must either be laid on top of others or else all the books in less crowded cases shifted to make space for it. The removal of the books on plant physiology relieved somewhat the congestion in that section, but the condition on the first and second floors is very crowded, with practically no room for future expansion.

New Accessions.—Although no collections were received by the Garden library in 1927, the number of accessions was almost one-third again as large as in 1926. In fact, more books and pamphlets were catalogued during the year than ever before in the history of the library. Some of the most noteworthy purchases made during the year are the following: Bonnier, Flore Complete de France, Suisse, et Belgique, pts. 81-90; 20 missing volumes of Botanische Centralblatt; Cole, Practical Physiological Chemistry; Vols. 1-4 of Colloid Symposium Monographs; Contemporary Development in Chemistry; Engler, Das Pflanzenreich, Heft 89; Engler & Drude, Vegetation der Erde, Vol. 9, pt. 5; Finnemore, The Essential Oils; Flora Batavia, pts. 426-429; Gaumann, Vergleichende Morphologie der Pilze; Gurwitsch, Das Problem der Zelltheilung; Henneberg, Handbuch der Gaerungsbakteriologie, 2 vols.; Korschelt, Regeneration und Transplantation, Vol. 1; Kostytschew, Lehrbuch der Pflanzenphysiologie, Vol. 1; Lewis, The Anatomy of Science; Linnaeus, Natuurlijke Historie af Beschrijving der Dieren, Planten, en Mineraalen; McDougall, Plant Ecology; Meisel, A Bibliography of American Natural History, Vol. 2; Millais, Magnolias; Morse, Biochemistry; Nordenskiold, Die Geschicht der Biologie; Schlechter, Die Orchideen, new edition; Thaysen & Bunker, The Microbiology of Cellulose, Hemicelluloses, Pectin, and Gums; Waksman, Principles of Soil Microbiology; West, A Treatise on the British Fresh-water Algae, new edition; and Wolcott, North American Wild Flowers, Vols. 2 and 3.

Many valuable books and pamphlets are also sent as donations or in exchange for Garden publications.

Garden Publications.—Four numbers of the ANNALS were issued in 1927—Numbers 1-4 of Volume XIV. The volume contains 432 pages, 41 plates, and 175 text-figures. On account of numerous requests for the ANNALS, chiefly from foreign institutions who were on the exchange list before the war, a larger edition of Volume XIV was printed. Ten new institutions were added to the exchange list during the year, and four new subscriptions were received. Of these, three were from the United States, two each from Russia and Germany, and one each from England, Finland, France, Greece, Italy, Mexico, and Turkey. The library now receives 1,500 serials on an exchange basis, some of which are in exchange for the BULLETIN. The work of editing and sending out these publications is done by the library staff.

The BULLETIN continues to be in greater and greater demand and is evidently one of the most popular points of contact between the Garden and the general public. An effort is made to have all of the articles authoritative, which frequently entails the rather laborious rechecking of minor points. This, however, seems to be worth while, since at the Nashville meeting of the American Association for the Advancement of Science the article from the BULLETIN on Thomas Jefferson, was read in its entirety before one of the affiliating societies as a model of popular scientific writing.

The ANNALS and BULLETIN are sold to subscribers. During the year $1,890.90 were received from the sale of these two publications, together with reprints and Books of Views of the Garden.

Statistical.—There have been donated to the library or received in exchange during the year 670 books, valued at $1,517.55; and 3,508 pamphlets, valued at $617.50. Three hundred and ninety-seven books were bought at a cost of $2,547.13, and 229 pamphlets at a cost of $396.48. The library now contains 43,318 books and 63,556 pamphlets, a total of 106,874. There are also 331 manuscripts valued at $1,614.80 and 944,987 index cards valued at $10,821.44, a total of 11,187 cards were added during the year, of which 809

were written by Garden employes and 10,378 bought at a cost of $218.81. Three hundred and twenty-two books were bound.

GEORGE T. MOORE,
Director.

STATISTICAL INFORMATION FOR DECEMBER, 1927

GARDEN ATTENDANCE:
Total number of visitors.....12,863

PLANT ACCESSIONS:
Total number of plants and seed packets received as gifts and exchange 176

LIBRARY ACCESSIONS:
Total number of books and pamphlets bought..... 52
Total number of books and pamphlets donated..... 271

HERBARIUM ACCESSIONS:
By Purchase—
Palmer, E. J.—Plants of Missouri..... 332
By Gift—
Durham, O. C.—Hybrid specimen of *Ambrosia* from Missouri 1
Grant, J. M.—Fungi of Washington..... 15
Hume, H. Harold—*Arisaema Dracontium* (L.) Schott from Florida 1
Greenman, J. M.—Plants of horticulture..... 1
Kellogg, John H.—Plants of Missouri..... 196
Miss Mildred E. Mathias—Plants of Missouri..... 6
Orpet, E. O.—*Agave Shawii* Engelmann from horticulture 2
Orpet, E. O.—Photograph of *Dracaena Draco* L..... 1
Powell, Paul—Specimens of *Sedum* from horticulture..... 2
Pring, George H.—Fruiting specimen of *Dioon edule* Lindl. from horticulture 1
By Exchange—
Conservatoire et Jardin Botaniques, Genève, by Dr. John Briquet—Plants of Savoy collected by Baron E. Perrier de la Bathie..... 560

Total 1,118

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Vandeventer avenue car line. Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

GEORGE T. MOORE,
Director

HERMANN VON SCHRENK,
Pathologist

JESSE M. GREENMAN,
Curator of Herbarium

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ERNEST S. REYNOLDS,
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JOHN NOYES,
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GRAY SUMMIT EXTENSION

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D. MILLER,
Orchids

R. E. KISSECK,
Engineer

TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER,
Manager

Missouri Botanical Garden Bulletin

Vol. XVI FEBRUARY, 1928 No. 2

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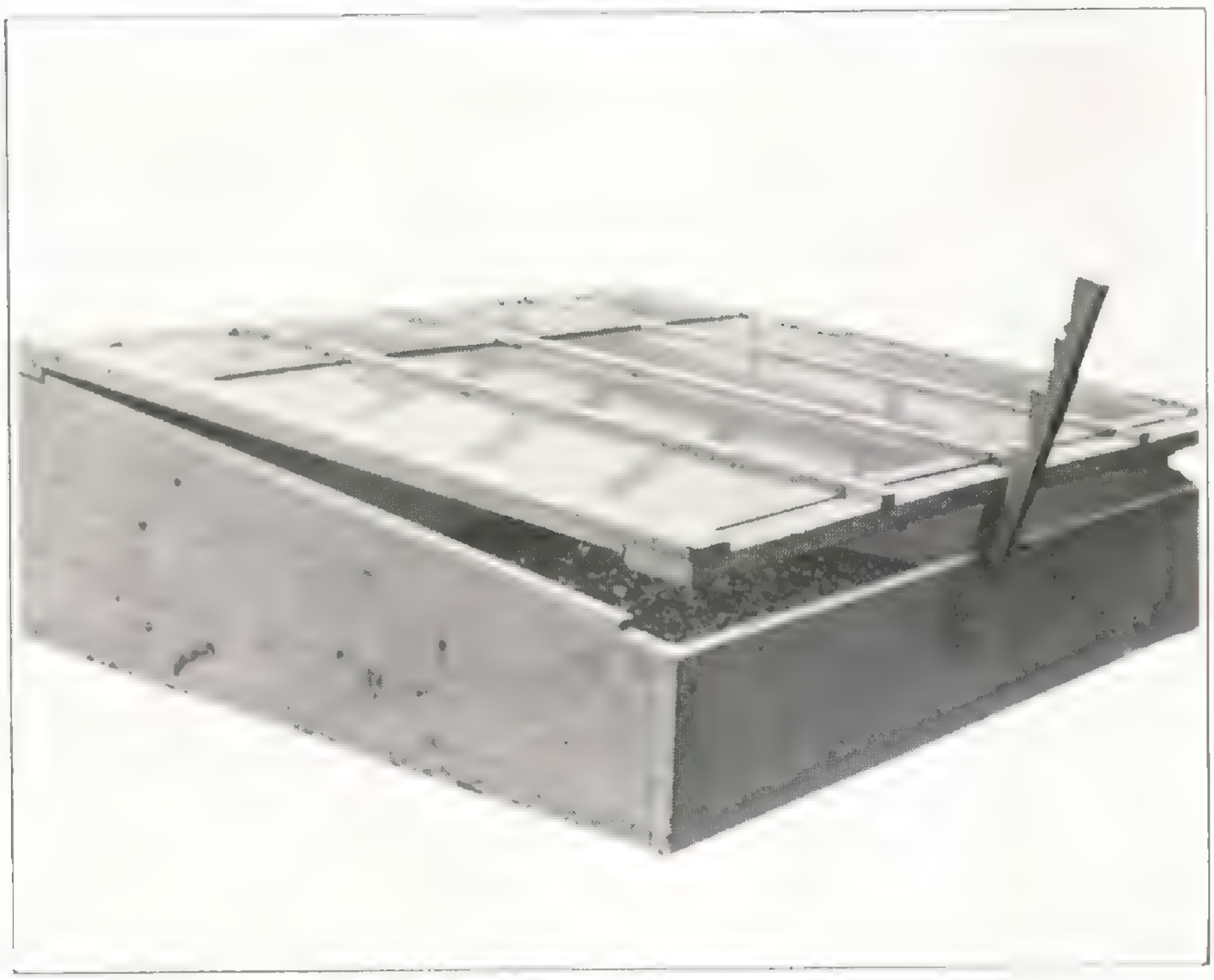


COLDFRAME.

POTS, BOXES, AND COVER-GLASSES.

Missouri Botanical
Garden Bulletin

Vol. XVI FEBRUARY, 1928 No. 2

GROWING PLANTS FROM SEED

With the beginning of the year the new seed catalogues make their appearance, and advertisements in magazines invite those interested to send for copies. Upon turning the pages of the catalogues the imagination of the gardener is excited, and he sees in his mind's eye his beautiful garden the following summer. However, the gorgeous illustrations and the many glowing descriptions of plants often arouse higher expectations than he is able to achieve. So often he blames the seedsman for the poor quality of the seed when they fail to germinate, but the fault is really his in not knowing how to start the plants. It is true that old seed sometimes find their way to various stores where they are kept from year to year, but if bought from reliable firms or from racks where the seed are guaranteed to be fresh, failure to grow plants must be laid to ignorance of garden principles. The object of this article, with accompanying illustrations, is to help the home gardener with his problems in raising plants from seed.

The seedsmen's catalogues are improving every year, both in illustrations and descriptions. Some firms issue catalogues which contain much helpful information with each kind of plant listed; others have instructions printed on the seed packets, and still others include cultural leaflets with every shipment of seed. One small packet of a variety usually contains all the seed necessary for the average garden if they are started indoors. If the seed are sown directly outdoors allowance must be made for the many obstacles that often prevent the seedlings from getting a good start. Torrential rains frequently wash away seed before they have had a

chance to germinate. If the soil is very heavy or has been poorly prepared the seedlings germinate, but lack the strength to develop further.

Any one intending to raise annuals or perennials from seed will find the beginning stage the most interesting. However, he must curb his enthusiasm and not start the plants too early in the season, or they become stunted and crowded before it is time to plant them out. As there always is some danger of cold weather up to the early part of May, it is best not to start the quick-growing kinds until a month or six weeks before time for planting outdoors. That means that most of the seeds should be sown toward the end of March and the beginning of April. Most perennials and those annuals that require a long period for their development may be sown in February. Such annuals are lobelia, pennisetum, petunia, salvia, snapdragon, verbena, and vinca. Another reason for delaying planting of the seed is the cold weather in February and March, and if the gardener is entirely dependent upon the coldframe for raising his plants he will lose some of them if started too early.

After the latter part of March the weather is generally warm enough for growing seedlings in a coldframe. Figure 1, plate 6, shows a small frame any one can build with little effort. It is not necessary to have a coldframe sash. Second-hand window sash can be obtained from house-wrecking companies for a few dollars, and the frame can be built to the size of the sash. If the seed are sown in April a glass cover for the frame is not absolutely necessary. Oiled-cloth, cheesecloth or even boards can be used as a covering when protection is needed in colder weather. If seedlings are already growing in the coldframe and a sudden drop in temperature down to the freezing point or lower is indicated, boards, old blankets, sacks, etc., may be used as an extra cover until warmer weather returns. However, a glass cover is an advantage, since sunlight can be admitted on cold days. Naturally, the plants in the frame with the glass roof would benefit by the few extra days of light, while those in practically total darkness would suffer to a certain extent.

In selecting a location for the frames in the garden a position should be chosen that is sheltered on the west and north

by a fence, building, or shrubbery. All frames should have a slope to carry off the rain, and this slope should be to the south. It is hardly necessary to state that the frame should be so placed that it is in the sunlight the greater part of the day. If near-by buildings shade the garden during a part of the day, a position receiving the morning rather than afternoon light should be chosen for the coldframes.

Sunlight is essential to the growth of plants. Seed may be sown in boxes or pots and set on any window sill. However, after the seedlings are up they must be placed in some window receiving sunlight. A southern window is best, but if this is not available one with an eastern or western exposure will do, the former being preferable. The temperature of the room should be between 60° and 70° F. When the sun shines through the window-pane the temperature mounts considerably, but this will be for only a few hours. A little fresh air during this time will greatly benefit the plants. After the seedlings are started they should be placed in a small frame outdoors if possible.

Pots, boxes, etc.—Tin cans, cigar boxes, discarded granite ware, pots, and special boxes termed flats may be used in which to start seed (fig. 2, pl. 6). Convenient boxes may be made of various sizes, but if very large they are heavy to handle when filled with wet soil. Two convenient sizes are 12x15x3 inches and 15x20x3 inches. A depth of 3 inches is sufficient for the short time the plants are in the flats.

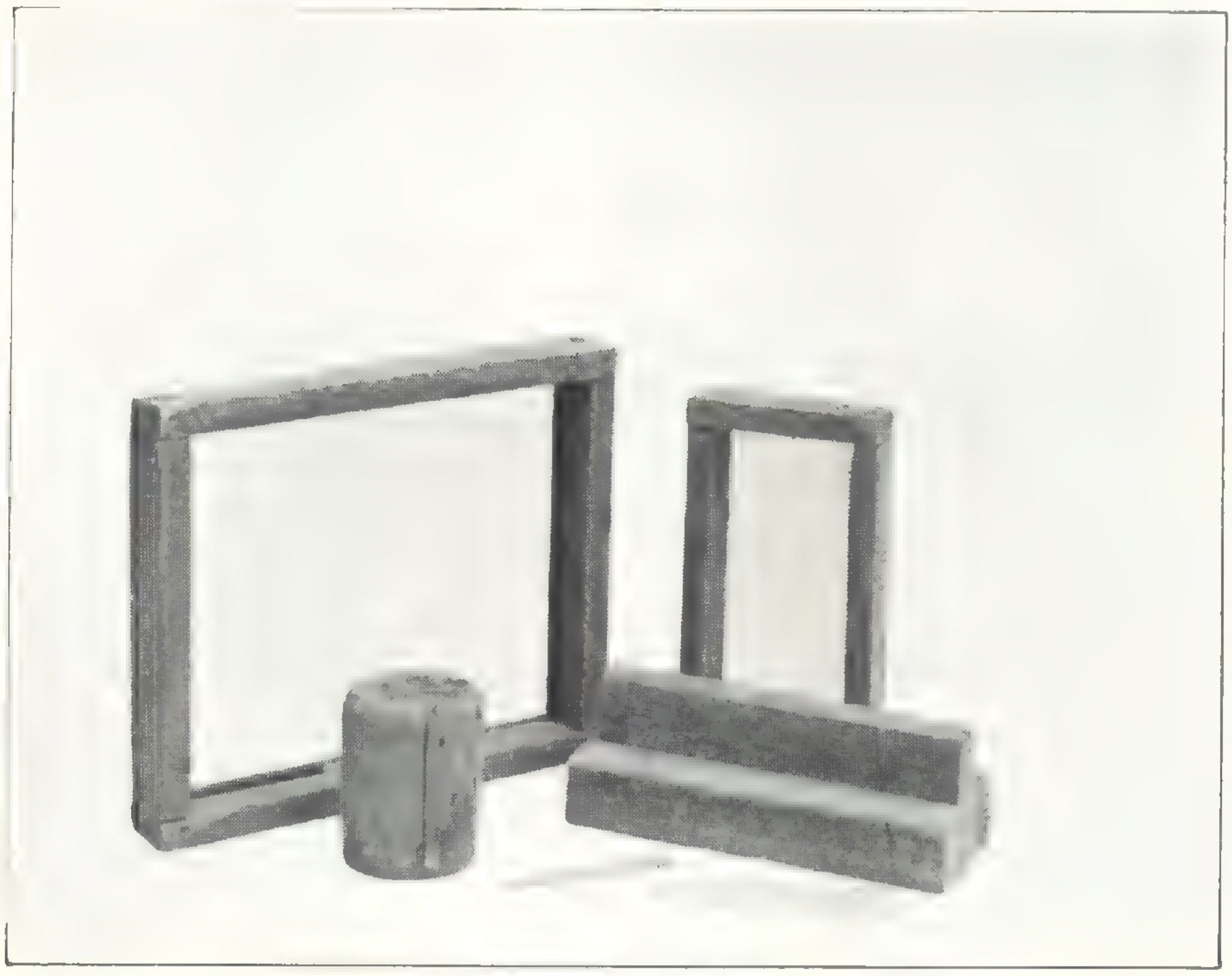
Drainage.—No matter what type of receptacle is used the bottom should have holes to let out the excess moisture. If the boxes are of wood the bottoms should have several holes bored in them or the boards should be spaced at least a quarter of an inch apart. If the boards that make up the bottom of the flat are placed too close together they will swell when moist and make the box water-tight. Any receptacle that does not permit the excess water to drain away will soon become waterlogged. The soil then becomes sour and the plants die. Even though provision for drainage is made it is well to place some coarse material in the bottom of any receptacle to prevent the fine soil from clogging the holes or cracks. For this purpose

broken pieces of flower pots (termed crocks), gravel, stones, and cinders may be used.

Flower pots come in various sizes, the size being measured by the diameter of the pot. A four-inch pot is about the smallest size that should be used for sowing seed. When only a very small quantity of seed is to be sown it is best to use a flower pot, the seed being broadcasted over the surface. If many kinds of seed are to be sown, most of which will germinate in about the same length of time, much space can be saved by sowing them in rows in boxes. Pots take up considerable space, while a small box can contain many rows of seedlings. Moreover, soil or sand in boxes will not dry out as rapidly as in pots.

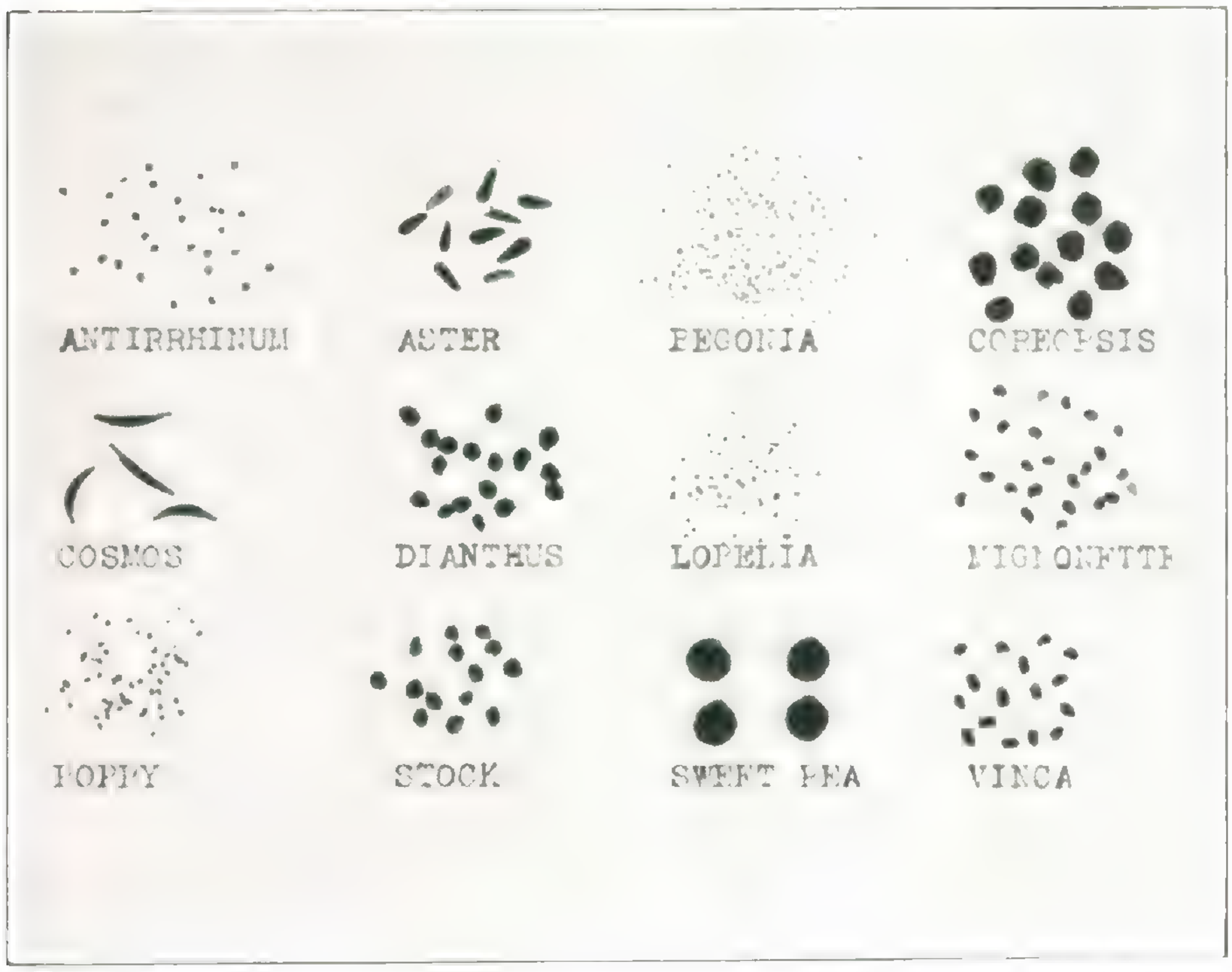
Sieves, tampers, dibbers, labels.—Any one interested in growing plants from seed should secure some essential tools. They are all very simple and can be easily made. Sieves simplify the operation of sowing seed, especially fine seed, and once they are used they become a necessity. A fine screen need not be more than six or eight inches square, but one with a coarser mesh for sieving large quantities of potting soil should be one by two feet or larger. The fine screen may be made by tacking a piece of window-screen wire cloth to a wooden frame. For coarser screens wire screening $\frac{1}{8}$-, $\frac{1}{4}$-, or $\frac{1}{2}$-inch mesh is used, the size of the mesh depending upon the nature of the soil and the purpose for which it is wanted. It would not only take a very long time to sift through a fine sieve all the soil necessary for some zinnias, but also it would not be best for the plants. Finely sifted soil packs with repeated watering, this excluding the air. The soil then becomes sour and the plants grown in it become stunted. The screen with the finest mesh is used only for small seed; for general use the sieve with a $\frac{1}{4}$-inch mesh is the proper size; for larger plants a coarser mesh should be used.

Figure 1, plate 7, shows two tampers, a square and a round one. The square one is easily made from a piece of one or two-inch lumber, and may be about 3x6 inches or longer. An ordinary brick may serve for a tamper, but is too heavy to be used for any length of time. The round tamper is useful



SCREENS, TAMPERS, DIBBER AND LABELS.

POTS OF SEED WATERED BY THE BUCKET AND THE CLOTH METHODS.



TWELVE KINDS OF GARDEN SEED

DIFFERENCES IN GERMINATION OF SEED SOWN AT VARIOUS DEPTHS.

when sowing seed in pots, an empty flower pot answering the purpose. A dibber is a small stick about the size of a lead pencil. It is used when seedlings are transplanted. Wooden meat skewers make excellent dibbers.

The name of the plant and the date of sowing the seed should always be written on a label. Later in the summer the plants blooming at the same time might fit into some particular color scheme. This scheme could not be duplicated another season unless a record were kept of the time the plants were started. Moreover, many plants in the seedling stage look so much alike that confusion might result unless they were labeled.

Watering cans and methods of watering seed pots and boxes.—The average sprinkling can that is sold in the stores throws a rather coarse stream of water. Extremely fine seed are barely pressed into the soil when sown and when watered with a heavy stream they are almost entirely washed away. Better types of cans may be purchased from seed stores and florists' supply houses. With a little care and patience seedlings may be started without the use of a watering can or with one of the poorer types. Figure 2, plate 7, shows two methods of watering seed. Setting the pot in a bucket of water and allowing the water to come up through the hole in the bottom until the surface of the soil becomes moist is an excellent way. With this method there is absolutely no danger of disturbing fine seeds as would be the case if watered from the top. One is also certain that the soil is thoroughly saturated with water. After the surface soil is moist the pot is removed from the bucket and the surplus water allowed to drain off before replacing the pot in the window or frame. In order to prevent too rapid evaporation from the surface, the pot is sometimes covered with a piece of glass or paper until the seed germinate. The sub-irrigation method will only have to be practised a few times before the seed are up. Another way to prevent the seed from being washed to the side of the pot or box when sprinkling with a can is shown in figure 2, plate 7. A piece of cloth is moistened and laid on the pot, and the sprinkling done through the cloth. The force of the water is broken by the cloth, and the mois-

ture oozes through to the soil. After enough water has passed through the cloth should be removed.

Types and sizes of seed.—Seed vary a great deal in size, shape, and the length of time required for germination. Figure 1, plate 8, gives a good idea of the sizes of some common flower seeds. It can easily be understood how difficult it is to raise some of these plants from seed when the essentials of germination are not understood. If the seeds of petunias and lobelias are covered with more than a quarter of an inch of soil failure to germinate may be expected, but if barely covered with soil or lightly pressed into the soil more seedlings will come up than can be used. Seed that are sown on the surface of the soil indoors or in a frame where practically all conditions of soil, moisture, light, and heat can be controlled will germinate readily, but if this were done in the open failure would result.

There is a certain relation between the depth that seed are sown and their power to germinate. Seed are frequently sown too deeply. A seed that is covered with much soil does not get the proper amount of air and has the added burden of pushing up the layer of soil above it. Air (oxygen) is absolutely necessary for the germination of seeds. Sow a seed the proper way and watch it germinate, but place some of the seed in water, which contains very little air, and they will rot. Figure 2, plate 8, shows very clearly what happens to seed sown at various depths. Those near the surface were the first to germinate and grow, and while some of the others lower down have germinated, the odds against them are too great and they will finally succumb. Some of the seed planted deep have already rotted. When sowing seed the extremely small ones should be pressed into the soil after it has been watered, or the sub-irrigation bucket method used. All small seed should barely be covered, just enough fine soil or sand being passed through the sieve until they are no longer visible. In sieving soil or sand over small seed the sieve should be held not more than an inch or two above the surface of the soil. If held higher, the particles of sand or soil striking the seeds will cause them to jump in all directions, with the result that some of them will immediately be covered and

the remainder will still be on the surface, or some will have a light covering and others a heavy one. This will result in uneven and many times poor germination. Larger seed, such as coreopsis, hollyhocks, asters, and cornflowers, may be sown somewhat deeper, being covered with about an eighth of an inch of soil.

Soil medium in which to sow seed.—Most seed have been and probably always will be sown in soil. It is the commonest material available and gives good results. The best soil for the purpose is composed of about one part loam, one part leaf-mold, and one part sand. By loam is meant a soil that contains a liberal amount of vegetable matter in the form of decaying roots, leaves, etc.

Sand is the most convenient material in which seed may be sown. However, if sand is used the seed require much closer watching. After a seedling has germinated and the roots are formed they begin searching for food. Sand is practically devoid of any food material. Consequently as soon as the seedlings have germinated and are large enough for handling they should be transplanted to pots or boxes containing soil. If left in pure sand for a length of time they will remain alive, but will be stunted. Sand dries out rapidly, and if not kept constantly moist the seedlings will be lost at the critical time of germination. Seedlings that have germinated and whose roots extend down about an inch will not suffer if the surface sand becomes dry. However, extremely fine seed that are very near the surface might just be germinating when the surface dries out, and if the sun is shining they will be lost in a short time. Aside from the two main objections to sand as a germinating medium—lack of food and the rapidity with which it dries out—it has so many good qualities that it cannot be overlooked as a material in which to sow seed.

Seedlings are always subject to the ravages of the damping-off disease. This disease can attack a crop of seedlings and destroy them over night. Figure 1, plate 13, gives a good illustration of the nature of the disease and its work. The thread-like structure of the parasite spreads over the surface of the soil and attacks the seedlings. The illustration referred

to shows zinnia seedlings in various stages of the attack. The first one has threads of the mycelium around its base; the second and third have already lost their roots; and the fourth seedling has completely collapsed. This disease is always associated with a great amount of humidity, and on that account seedlings or seed boxes in which the seed are just germinating should never be watered toward evening. The surface of the pots or boxes should be dry at night, because it is at that time this disease is most active. If seed are sown in sand instead of soil there is much less danger from attacks of the damping-off disease. One of the chief reasons why sand is so much better than soil for sowing seed is that it does not retain as much moisture as soil, even though it is watered more frequently. Seedlings will be lost by the damping-off disease, even if sown in sand, if the seed are crowded or if the air about the seedlings is very humid. This humid condition can easily be created if the cover glass or paper is left on the boxes or pots after the seedlings are up.

Seedlings germinate more uniformly in sand than in soil, and when they are pushing up the sand rolls to the side. Seed sown in soil and covered with a layer of soil often have difficulty in pushing up, or if the seedlings are close together a whole crust of soil is pushed up, much to their detriment. Seedlings are much more easily separated for transplanting when grown in sand than in soil. Because sand drains so readily it always warms up quicker and this hastens germination. The better germination in sand is well illustrated by the tomato seedlings shown in figure 1, plate 10. One pot contained pure sand, the other soil, and the two pots were treated alike in all respects. If the sand is dirty, it should be washed. To do this a bucket is filled about half full of sand and water run in through a hose. The dirt, being lighter than sand, will float and will be carried over the top of the bucket. Moving the hose about will rapidly free the dirt, and when the water is clear the sand is clean.

Sowing the seed.—Plate 9 shows the essential operations in the sowing of seed in boxes, and with few exceptions the same methods hold true if pots or any other receptacle are used. As previously mentioned, the box should have holes or cracks

SEED-SOWING OPERATIONS.

TOMATO SEED SOWN IN SAND AND SOIL, SHOWING MUCH BETTER AND QUICKER GERMINATION IN SAND

SPROUTING SEEDLINGS.

in the bottom. The first step is to cover these openings with broken crock, stones, etc. The box should then be filled to overflowing with sand or soil, leveled with a stick, and tamped lightly. The surface of the soil will then be about ⅜ of an inch below the top edge of the box. If the soil or sand is an inch below the top of the box much trouble may be anticipated with the damping-off disease due to the poorer air circulation. After the soil is tamped, the rows are marked with a stick or plant label, the stick being pressed into the surface to the depth wanted for the seed. For fine seed the surface is barely marked, for large seed a deeper trench is required. Before making the rows the soil or sand must be moist, for if dry it immediately rolls back in the trench when the stick is withdrawn. After the rows are made the seed is ready for sowing, and for convenience one corner of the seed packet is torn off and the packet lightly tapped to secure an even distribution of the seed along the rows. It is best to allow one row for each kind of seed, or at the most one-half row for a kind. In this way the label can be placed either at the beginning or at the end of the row. If labels are placed in the rows they will interfere with the glass or paper cover.

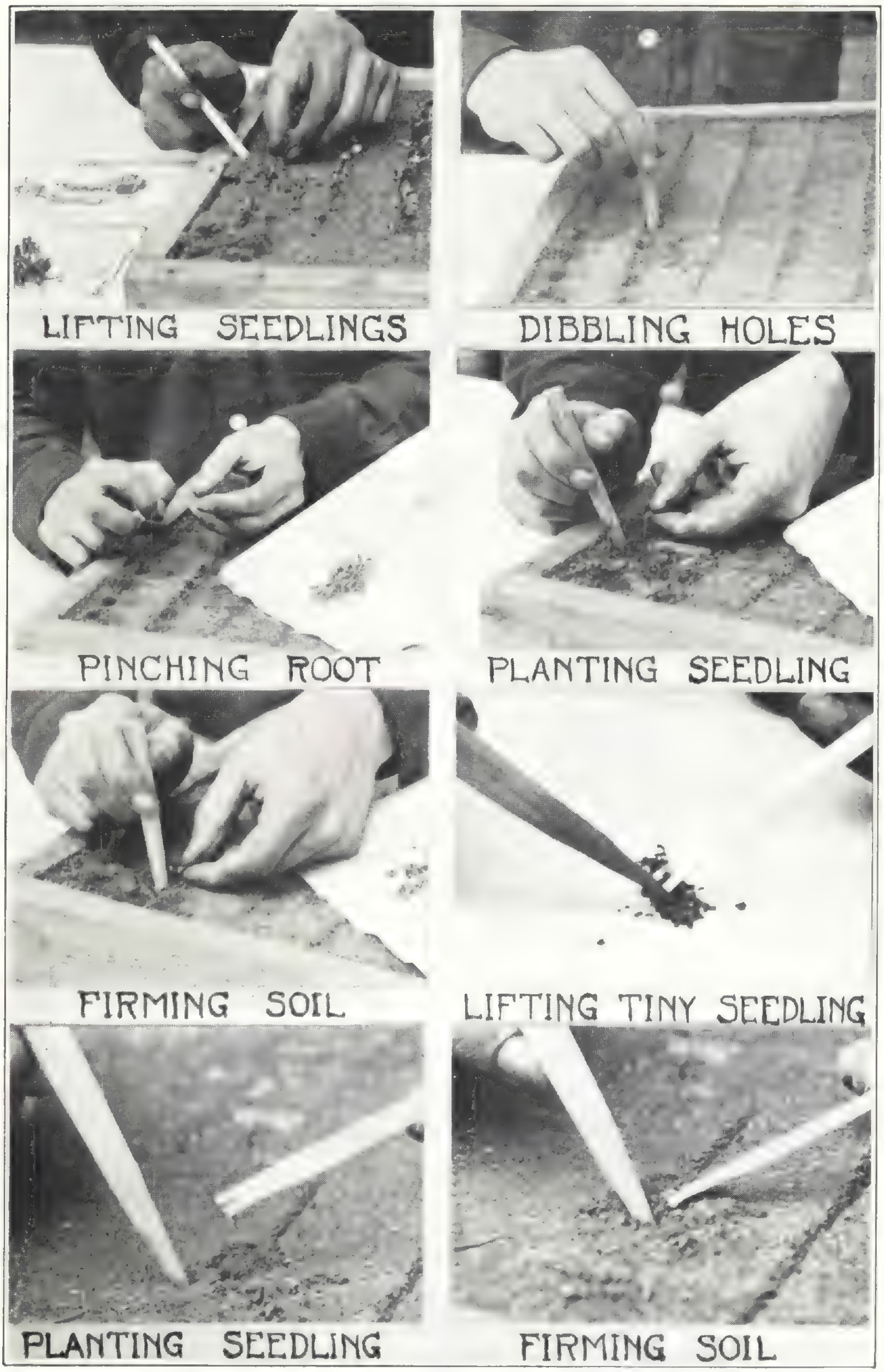
A mouse can do much damage in a pot or flat of seed in one night, so the pot or box should be covered with a sheet of glass or a board. After the seed have germinated and are growing there is seldom any danger from mice. While on the subject of losing seed by other means than the damping-off disease it might be well to warn against the cunning antics of ants if they are in the neighborhood of a box of seeds. Ants will carry away any seed that is not too large for them to handle. They prefer seed just as they are germinating, but will also carry away newly sown seed. As they are wont to lick anything, be it insect or seed, that exudes a sweet substance, they supposedly carry the seed to their nests. It is very disheartening to discover that the fine seed that was so painstakingly sown the previous day has been and is being carried away by an army of ants. They will sometimes appear when least expected. If they are in the neighborhood of a box of seed it is well to place a water barrier between them and the seed box. One or more saucers of water in which

empty pots are inverted and on which the box of seed is set will prevent them from causing any trouble. If only a pot of seed is to be protected it may be stood on a half brick in a saucer or pan of water. If many pots or boxes are used they may be set on a platform supported by standing four bricks in water.

After the seed are all sown sand is sieved over the rows. If some sand has been set aside to dry, it will run through the sieve very easily. The deeper rows containing the large seed should receive a heavier covering than the small seed in the shallow rows. After the seed are all covered the flat is watered and then a pane of glass or a piece of paper or both are placed over the box. Moisture will accumulate on the glass and should be removed each morning. If the glass is carefully removed from the pot and held by one corner, the water will run off quickly. If the glass is carelessly removed the large drops of water will splash fine seed in all directions. When the seed begin germinating the glass or paper should be raised slightly at one side to admit air, and after the seedlings begin pushing through, the box should be uncovered. A great many seedlings will be lost if the cover is left on too long. The close atmosphere under the cover is ideal for the spread of fungous growths.

In the last few years various preparations have been placed on the market that will check and prevent fungous diseases associated with germinating seedlings. Figure 2, plate 13, shows some of these materials. They may be used either dry or in liquid form.

Eight operations in transplanting seedlings.—After the seedlings are up and are sufficiently large to handle they are ready for transplanting. Removing seedlings from their boxes should not be postponed too long. While seed should not be sown thickly they are always more or less crowded in the boxes or pots and should be separated from their neighbors as soon as possible. Plate 11 illustrates the various stages of transplanting seedlings. The majority of seedling plants are sufficiently large to be handled with the fingers. They either have a leaf large enough to act as a handle or are strong enough to be held by the stem. Whenever possible a seedling should



TRANSPLANTING OPERATIONS.

CULTIVATING SEEDLINGS.

SEEDLING SNAPDRAGONS READY FOR POTTING.

be held by a leaf, as then there is less danger of crushing the tender plant. Some seedlings, notably petunias, lobelias, begonias, etc., are so very small that it is impossible to handle them with the fingers. The last three figures of plate 11 show how minute seedlings are handled.

The box into which the seedlings are to be transplanted should contain some drainage material and should then be filled up with a light soil. The box is leveled and tamped in the same manner as when the seed were sown. The surface should be finished with some finely sifted soil and tamped. If this is not done, especially when small seedlings are to be transplanted, the small lumps of soil will cause much annoyance. If the box of soil is very dry it should be watered before transplanting the seedlings and then set aside. A box of soil that is damp and needs no water is to be preferred to one that has been watered an hour before being used. Soggy soil is a nuisance. It clings to the dibble and the fingers.

To remove the seedlings from the seed box, with the right hand insert a stick or plant label beneath the roots and gently raise a bunch of seedlings, at the same time grasping them with the left hand. Lay them on a piece of paper and bring them to the box of soil. Do not take all of the seedlings from the box at one time as they dry out very rapidly. Mark the rows on the surface of the soil with a straight-edged stick. Space the rows in the flat from one and a half to two or three inches apart, depending upon the size of the plants. Also space the plants the same distance in the rows. The size of the seedlings soon after germinating serves as a fair indication of the distance apart to transplant them. The larger the seedling the more space it will occupy in a given time. With the dibber make a hole in the soil deep enough to receive the roots without crowding. Slightly turn the dibber back and forth as it is withdrawn from the hole to prevent any soil from rolling back. If the seedlings have unusually long taproots, pinch them back half way. This will do no harm and will cause the plantlet to send out lateral roots. After the seedling is placed in the hole the dibber is again thrust into the soil near the seedling and the soil firmly pushed against the roots. If an air pocket is left at the bottom of the hole the

roots cannot come in contact with the soil. Many seedlings poorly transplanted will survive, but in order that they may not be checked in growth the soil should be immediately brought in contact with their roots. Seedlings should be transplanted at about the same depth as they were in the seed box. However, when seedlings are very spindly and have a tendency to shoot up, they should be planted deeper in the hole. There are some kinds of seedlings, the delphinium being an example, in which the heart of the plant is quite low. In transplanting such seedlings one must be careful not to cover the center of the plant, lest it might rot. Again there are seedlings that produce robust plants that are quite large (lupines, castor beans, etc.). These should be immediately set into two or two and one-half-inch pots.

In order that minute seedlings may safely be transferred to flats of soil a small wooden fork made from a plant label or any piece of thin wood is used. With this fork the seedling is lifted and if it clings to some of the others they are separated with the dibber. The dibber for transplanting tiny seedlings should have more of a point than the ordinary dibber. A collection of dibbers of various thicknesses for different sizes of seedlings will prove most convenient. Holding the wooden fork with the left hand, lift the seedling to the seed box, barely make a depression in the soil, then lower the seedling and firm a little soil around it with the dibber. Tiny seedlings must be carefully watered until they produce enough roots to hold them in place. A watering pot with a fine-spray nozzle is essential to such work. If very small seedlings are set in a flower pot they can be watered by the sub-irrigation bucket method. After the flat is filled with plants it should be watered and placed in the frame or window. If the sun is shining brightly, shade the plants with paper the first and second days.

Seedlings that have been crushed or broken in handling will wilt and die. If they are transplanted to a pot instead of a box, and this can be done if only a few dozen of a kind are wanted, the surface of the soil should not be more than one-fourth inch below the top of the pot. Larger seedlings may be set deeper. Seedlings planted in flats will not dry out

ZINNIA SEEDLINGS ATTACKED BY THE DAMPING-OFF FUNGUS.

CHEMICAL PREPARATIONS THAT WILL CONTROL DAMPING-OFF DISEASES.

as rapidly as those in pots, and more can be grown in a given space if planted in rows in flats than if grown in pots. After the seedlings are in the flats for a length of time the soil becomes packed by repeated watering. Weed seeds will also have germinated and will begin to crowd the seedlings. Cultivating the flats (fig. 1, pl. 12) will discourage the weeds and will benefit the plants. Seedlings that grow too rapidly and show no signs of branching should be pinched when they become two and three inches high. When the seedlings become crowded they should be transplanted to pots (fig. 2, pl. 12). If it is intended to leave the seedlings in the flats until time for planting directly into the garden, then they should have more space in the flats when they are transplanted from the seed-box.

Seedlings that are to be transplanted to pots should be carefully lifted with a spoon or plant label and should have as much soil adhering to the roots as possible. The plant is held in the center of the pot. Then the soil is added and firmed about the seedling. After transplanting to pots, water the seedlings thoroughly. One watering is usually not sufficient, especially when the potting soil is quite dry. On clear days shade the seedlings by laying newspapers over them. The larger the seedling at transplanting time the greater the danger of wilting. This is due to the number of roots that are torn when removing the plants from the boxes. Several copious waterings and shade one or two days after the operation will restore any plant to its former vigor.

When warm weather has arrived and the flower beds are prepared the plants are taken out of the pots and set in their place. Plants whose roots have become matted due to the length of time in the pots should have the bottom roots loosened before planting. This will break up the distinct ball the roots have been forming and will cause them to strike out in all directions and take hold of the soil in the flower bed. Plants that have been planted in beds should receive a good watering as soon as possible after all are set. The same precautions used when transplanted from boxes to pots must be taken against wilting when planting the seedlings in the flower beds. Cloudy weather is ideal for planting flowers outside.

Late afternoon and evening is better than the morning for transplanting as the plants can revive during the night. Transplanting should not be done on extremely hot and windy days. A good gardener will find ways and means to overcome all the difficulties that will at times confront him.

NOTES

Mr. L. P. Jensen, Arboriculturist to the Garden, has been elected a member of the Board of Directors of the St. Louis Horticultural Society.

Mr. L. P. Jensen, Arboriculturist to the Garden, spoke before the Methodist Church, at Gray Summit, Missouri, January 27, on "Conservation of Native Plants."

Mr. George H. Pring, Superintendent of the Garden, returned from Panama, February 22, bringing with him five cases of Panamanian orchids.

Dr. George T. Moore spoke before the Rochester section of the American Chemical Society, at Rochester, New York, January 9, on "Unnecessary Smoke: A Menace to Life, Property, and Pursuit of Happiness"; and on February 2 gave an illustrated lecture before the St. Louis Academy of Science, on "The Application of the Moving Picture to Scientific Work."

Volume XIV, Number 4, of the Annals of the Missouri Botanical Garden has recently been issued with the following contents:

"Cotton Wilt: A Pathological and Physiological Investigation," by David C. Neal.

"Species of Cercospora on Smilax in the United States," by L. O. Overholts.

Recent visitors to the Garden include Dr. E. M. East, Professor of Genetics, Harvard University; Dr. P. C. Mangelsdorf, Agronomist, Texas Agricultural Experiment Station, and Dr. John Winthrop Sargent, of the American Geographic Society.

Dr. J. S. Cooley, formerly a Lackland Fellow at the Garden, now in the Bureau of Plant Industry, United States Department of Agriculture, stopped over in St. Louis on his

way to Hood River, Oregon, where he expects to make a study of the anthracnose of apples.

Dr. Edgar Anderson, Geneticist to the Garden, has been giving a series of radio talks over Station WIL. The following subjects have been discussed: January 23, "The Missouri Botanical Garden"; January 30, "Plant Explorers"; February 6, "Plants and People"; February 13, "The Development of a New Spray"; February 20, "Botany and Business."

The orchid show has continued throughout the month and has attracted an unusual amount of attention. The new hybrid cymbidiums were shown this year for the first time. Visitors who came during the early part of the show were surprised, when they returned a month later, to find the same flowers still on exhibit. As a matter of fact, it is nothing unusual for a cymbidium to remain in bloom for six weeks. In one case a spike of flowers was shown at the London show, then taken to the continent to be exhibited, and finally brought to New York and displayed there.

STATISTICAL INFORMATION FOR JANUARY, 1928

GARDEN ATTENDANCE:

Total number of visitors.....16,771

PLANT ACCESSIONS:

Total number of plants and seed packets received as gifts.. 24

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 45
Total number of books and pamphlets donated..... 189

HERBARIUM ACCESSIONS:

By Purchase—

Bucholtz, A. F.—"Fungi Rossici exsiccati," Fasc. I-IV and XI-XIV 500
Weigel, Theodor Oswald—Miquel, W. "Kryptogamae Germaniae, Austriae et Helvetiae exsiccati," Fasc. XLI and XLII, Nos. 176-225; Fasc. XLIII and XLIV, Nos. 276-325.. 100
Weigel, Theodor Oswald—Jaap, Otto, "Myxomycetes exsiccati," Series X..... 12

By Gift—

Brooks, Dr. S. C.—*Berberis* sp. from horticulture..... 1
Kellogg, John H.—Plants of Missouri..... 324
La Garde, Dr. Roland—*Primula* sp. from horticulture..... 1
Pring, George H.—*Cycnoches Warscewiczii* Reichb. f. specimen from horticulture..... 1
Ridgway, Robert—Plants of Illinois..... 68
Ruth, Albert—Plants of Texas..... 2

By Exchange—

Arnold Arboretum of Harvard University—Plants of Europe, the West Indies, and New Caledonia..... 329
Demaree, Professor Delzie—Plants of Arkansas..... 73
Field Museum of Natural History—*Senecio* sp. from Peru.. 1
Philadelphia Academy of Natural Sciences, by Dr. F. W. Pennell—Plants of southern New Jersey..... 150
University of Montreal, by Brother Marie-Victorin—Plants of Quebec, Canada 263

1,825

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Vandeventer avenue car line. Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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Missouri Botanical Garden Bulletin

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NEMESIA
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Missouri Botanical Garden Bulletin

Vol. XVI MARCH, 1928 No. 3

FLOWERS FOR THE SMALL GREENHOUSE

Every year sees an increase in the number of amateur gardeners with private greenhouses. With their needs in view the following list of dependable flowers for the home greenhouse has been prepared. It omits certain commonly grown bulbs, such as narcissi and tulips, whose culture has been described in previous issues of the BULLETIN and with whose treatment most greenhouse owners are already familiar. It includes only those plants which repeated tests have shown to be thoroughly reliable.

AMARYLLIS *(Hippeastrum* sp.*)*

Large bulbs with strap-shaped leaves and red or white flowers in February and March. Flowers borne in clusters of 1 to 4 on a 2-foot stalk.

Buy bulbs of flowering size, pot in the fall, and water occasionally. When signs of growth appear bring into a warm house. After plants have bloomed leave indoors until warm weather, then plunge pots flush with soil in cold-frame or other sheltered spot out of doors. Bring indoors before frost, lay pots on side, and keep comparatively dry, but not so dry that the bulbs shrivel. Repotting is not necessary every year and should not be done until the pot is well filled with roots. In any case never put a small bulb in a large pot. When plants are forced again they may be given a slight top dressing of *very well-rotted* manure.

BEGONIA

Begonias of the "Gloire de Lorraine" or of the "Glory of Cincinnati" strains will flower more or less continuously dur-

ing the winter. Begonias are difficult to raise from seed, and the beginner will do well to buy his plants from the florist or from any of the growers who advertise in the trade papers. When they are being brought into flower they do best in a warm house (temperature not below 60° F. at night). After they have come into flower a lower temperature will make the blooms last longer.

CARNATION

Buy rooted cuttings in early spring. Grow in field during the summer, pinching them back to produce stocky plants. About September plant them in the greenhouse in beds or pots. Keep the house cool, but above 50° F. As the flower shoots develop pinch off the lateral flower buds and support the flower shoots with stakes. Root cuttings in January and February for next year's crop.

CINERARIA *(Senecio cruentus)*

Large-leaved pot plants bearing enormous clusters of brilliant daisy-like flowers.

These may be grown from seed, but the beginner will do well to buy his plants from specialists who advertise in the trade papers. Plants are also handled by a few seedsmen. For a succession of flowers make sowings in early August, early September, and late September. Do not allow the plants to become pot-bound until they reach the 5- or 6-inch pots in which they are to be flowered. Those who object to the brilliant cerise and purple of the commoner varieties may find the salmon pink and terra-cotta shades, which may be purchased separately, more to their liking.

CYCLAMEN

Inasmuch as these plants take 18 months' careful attention to bring into flower from seed, the small grower is advised to buy young plants. To keep down the cyclamen mite, spray once a week with nicotine in twice the customary strength. Grow in a cool house.

FORGET-ME-NOT *(Myosotis* sp.*)*

Winter-flowering types should be sown about August 1. Sown at this time they will flower from January to March.

GERBERA JAMESONI

STOCK (MATTHIOLA INCANA)

ASPARAGUS PLUMOSUS, SANSEVIERIA, ASPIDISTRA, ASPARAGUS SPRENGERI

PHILODENDRON; IVY, SHOWING METHOD OF TRAINING ON FRAME

Keep in a cool house. Several plants (3-4) in an 8-inch pot will make a better showing than one plant in a smaller pot.

GERBERA *(Gerbera Jamesoni)*

Perennials with dandelion-like foliage and large flowers borne singly on graceful stems. Flowers in attractive shades of red, orange, and yellow. Excellent as cut flowers.

Good seed is important. Sow in spring indoors, transplanting seedlings outdoors in May. Plants carefully lifted with roots intact and grown in either a cool or warm house will blossom indoors during the late fall and again in March if given a rest after their first flowering. Such plants may be kept for several years.

HYACINTH

Easily grown, requiring only a few weeks to force. Pot bulbs in October or November and store in cool cellar or cold-frame. Water thoroughly and occasionally inspect to see that they do not dry out. Protect from severe freezing and leave outdoors for at least 8 weeks. Bring indoors about February 1 and keep under bench for a week, watering twice a day. Remove to a cooler house and finish forcing on a shaded bench (4 to 5 weeks, depending upon the variety). Slow forcing gives firmer plants.

MARGUERITE *(Chrysanthemum frutescens)*

Grow from spring- or fall-rooted cuttings. Keep in cool house and pinch back to produce bushy plants. Spring-rooted plants are carried over the summer in pots plunged in a cold-frame. Both white and yellow-flowered varieties are known. Commonest white variety is "Paris Daisy." "Mrs. F. Sanders" is an improved variety with larger flowers. "Boston Yellow" is a good yellow.

MARIGOLD *(Calendula officinalis)*

May be grown almost continuously throughout the winter if successive crops are planted. Plants started in September will bloom in March. Grow in a cool house (40-50° F.). Pinch back the first bud to make plants branch out. "Orange Prince" is the standard greenhouse variety.

NEMESIA *(Nemesia* sp.*)*

Low-growing plants with numerous bright-colored flowers in various patterns of red, white, and pink. Plants started from seed in October will blossom in March. Grow in cool house. Several plants in a low pan give the best effect.

LILY *(Lilium longiflorum)*

Flowering plants need to be rooted on the stem as well as on the bulb. This may be accomplished in two ways: first, by starting the bulb in a small pot and transplanting it later into a 6- or 7-inch pot, setting it deep enough to give the stems a chance to send out roots; second, planting the bulb deep in a large pot, but adding soil only to just above the bulb. After the bulb has developed the pots may be filled to just below the rim.

SCHIZANTHUS *(Schizanthus* sp.*)*

Sometimes called "butterfly flower" or "poor man's orchid". Sow at intervals from September to November. Plants started in October should flower in March. Keep greenhouse as cool as possible and pinch back young plants to produce bushy specimens. Pot-bound plants will start to flower, and a few may be left in small pots for early flowering. The remainder moved into larger pots will bloom later but produce finer plants.

SNAPDRAGON *(Antirrhinum* sp.*)*

Grown from cuttings or seeds. Grow in cool house. If bothered with rust keep water off the leaves. Support with light bamboo stakes.

STOCKS *(Matthiola incana)*

August-sown plants will flower in February and March. Finish in 6- or 7-inch pots. A strong feeder.

SWEET ALYSSUM

Very easy to grow. November-sown plants will bloom in March. Sow earlier if wanted for early winter. Can be grown in bench between larger flowers.

SWEET-PEAS

Grow in beds or deep boxes (not less than 15 inches deep). Buy seeds of winter-flowering varieties, sow in pots, and transplant to permanent beds when seedlings. In small greenhouses may be grown along side the greenhouse bench, the boxes standing in the walks. Strings from roof to box make good supports. Frequent syringing of foliage will keep down red spider. Grow in cool house. Buds will drop during long periods of cloudy weather.

FOLIAGE PLANTS

Greenhouse foliage plants are legion. The following have been selected for their reliability and adaptability to home decoration and use with cut flowers.

ASPARAGUS FERN (*Asparagus plumosus* and *Asparagus Sprengeri*)

Similar in general effect, but the former is more delicate and fern-like. Easily grown from seed or by dividing old established plants. Can be grown in shady part of house. Syringe frequently. *A. plumosus* will do best with a few light stakes.

ASPIDISTRA

An iron-clad foliage plant. Can be grown under benches or in any other unfavorable part of the greenhouse.

BOWSTRING HEMP (*Sansevieria* sp.)

Almost as hardy and of similar usefulness. Can be grown easily from cuttings. Several plants in a wide pan are more effective than one in a smaller pot.

IVY

Easily grown from cuttings. Cuttings should be made from a leaf with an attached "heel" of stem. For formal decoration may be grown on trellis work in globes or pyramids to imitate trimmed boxwood.

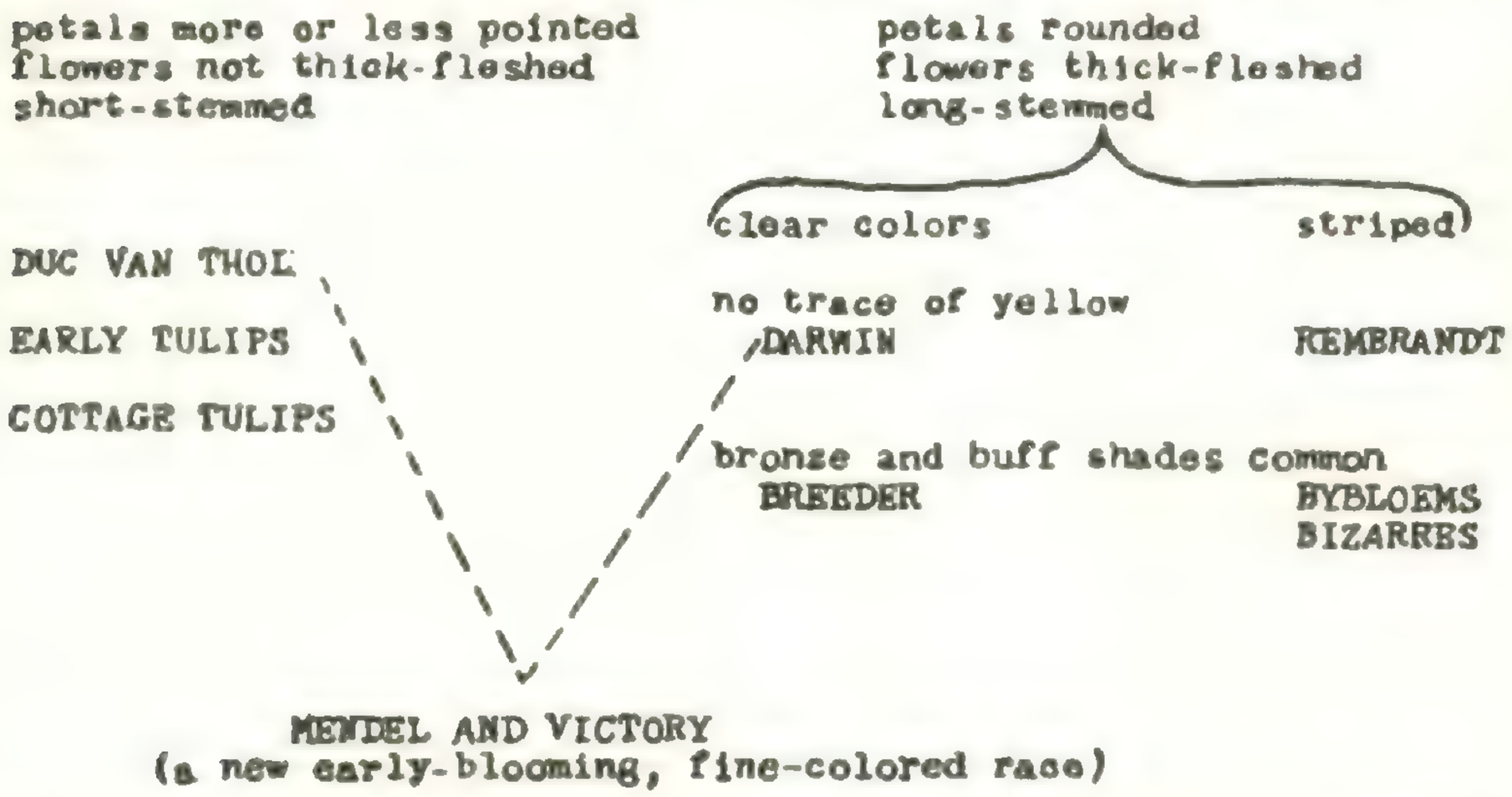
PHILODENDRON

Grown from cuttings. Easy to grow and reliable for home decoration.

A NEW CLASS OF TULIPS

At the second annual spring flower show the Garden had the privilege of showing, for the first time in America, over 50 varieties of a new class of tulips which have been named "Mendel" and "Victory" tulips. Produced by crossing the very early "Duc van Thol" with the well-known "Darwin" tulips, they combine the beautiful colors of the latter with the earliness and good-forcing qualities of the former. They force so readily, in fact, that it has not been easy to hold them back for the flower show, and they probably would have made a better appearance if they could have been presented to the public in January.

"But what is a 'Darwin' tulip, and what a 'Duc van Thol'?" the reader may ask. And how may one tell them apart? It is no easy task to classify all the garden tulips. Introduced into European gardens in the sixteenth century, they have had a long and checkered career. Waves of popularity have come and gone. Fashions in tulips, like fashions



in dress, have changed with the times. At certain periods cup-shaped, rounded-petaled varieties have been the style and other forms were neglected. Sometimes striped and streaked colors have been the fashion and at other periods they have been grown only as freaks. In this consequent welter of forms, certain outstanding types appear, but any classifica-

tion can be only approximate. The most general recognized types of garden tulips are outlined in the accompanying diagram.

The "Duc van Thols" are the very earliest. They are small-flowered varieties seldom seen in this country. The early tulips are next to bloom and are much larger in size. They are the common early-flowering tulips of our parks and gardens. The "Cottage" tulips, like the "Darwins," are later-flowering, and are still larger in size. They are the only late tulips with clear yellow tones in the flower. Their name recalls their checkered career. During the tulip mania of the seventeenth century they were among the most fashionable of flowers, but they subsequently fell from popular favor and became the poor man's flower. When tulips came into popularity again the better sorts were collected from cottage gardens and used in building up a new race. Many of them are characterized by long, more or less pointed petals.

The remaining classes differ only in color. They are all strong and tall-growing sorts with thick-fleshed flowers of considerable substance. Their petals are so rounded that the flower itself is practically globular. The "Darwins" and "Breeders" are characterized by clear, unbroken colors, without stripes or feathering of another color. The main difference between them is that while the "Breeders" may be and often are bronze or buff or orange in their general tone, the "Darwins" never show a trace of yellow in their make-up.

The "Bybloems," "Bizarres" and "Rembrandts" are all striped or streaked with a combination of colors. The "Rembrandts" are "Darwins" with an additional striping or feathering of color. In the language of the trade they are "broken" "Darwins." The "Bizarres" and "Bybloems" are similarly "broken" "Breeders." They differ in color, the "Bybloems" being feathered or striped with rose or violet on a white background, while the "Bizarres" have dark brown or brownish red stripes on a yellow background. At one time these varieties were the only fashionable sorts and the "Breeder" tulips were grown merely because they gave rise to the striped forms under certain conditions of culture.

As might be expected in a group so recently hybridized, the "Mendel" and "Victory" tulips are extremely variable. In color they range from the fresh tints of the "Duc van Thols" to the pastel shades of the "Darwins," and sometimes combine the color pattern of the former with the characteristic colors of the latter group. The following three varieties were the most outstanding among those exhibited by the Garden: "Algieba," a clear, pale lilac; "Shubert," red pattern on orange background, black-centered, petals with a central streak of bright carmine; "Zenobia," red pattern on lighter red background.

"D. S. BROWN," A NEW VARIETY OF CATTLEYA TRIANAE

In their native homes the South American cattleyas vary markedly, both in form and color. If orchid collecting were done at blooming time this variation might be taken advantage of and only the finest-flowered sorts would be selected. Unfortunately this cannot be done for the plants must be gathered during their resting stage when there is no way of telling what sort of flowers are borne by the individual plants. For this reason, the flowering of a collection of newly collected orchids is awaited with interest, since no one can predict what forms may appear.

The tulipans (*Cattleya Trianae* Lind. & Reichb. f.), collected for the Garden in the Andes of Colombia in 1923, have come up to all expectations. Among them have appeared several new types of distinct horticultural merit. The orchid connoisseur prefers a flower with wide sepals and petals, which practically overlap and eliminate the wide gaps so conspicuous in the poorer sorts. The lip or labellum should be a large trumpet, completely inclosing the column in its throat and flaring out into a graceful circle below. The preferred color for petals and sepals is rosy lavender to dark mauve, with a deeper, richly shaded contrasting color on the lip.

Among the 1923 importations one striking variety meets all of these requirements and is so distinct from all described forms as to merit a varietal name. It has accordingly been

CATTLEYA TRIANAE "D. S. BROWN."

named in honor of the late D. S. Brown, of Kirkwood, Missouri, whose gift of his entire orchid collection was the basis of the Garden's present supremacy in that line. As shown in the accompanying illustration, it is a well-balanced flower, whose gracefully drooping petals are attractively crimped along the edge. The sepals are one inch wide, three and a half inches long, and of a delicate rosy lavender. The petals are two and five-eighths of an inch wide and three and a half inches long and of the same color as the petals. The lip or labellum is two and one-half inches wide. It is a deep, glowing mauve at the throat, shading to golden yellow within.

THE NATIONAL FLOWER AND GARDEN SHOW

The exhibit of the Missouri Botanical Garden at the National Flower and Garden Show, held in Louisville, March 10-18, attracted a great deal of attention. The plants were shown in a glass enclosure three by ten feet. On one side of the enclosure were flowering orchids and pitcher plants, while on the other, orchids and other plants from the Tropical Station at Panama were arranged to represent a tropical jungle. *Nepenthes Dyeriana* aroused considerable interest on account of its large size, its "pitcher" easily holding a quart of water. The insectivorous plants and the orchids were objects of curiosity throughout the show.

Although the Garden exhibit was not in competition for a prize, it was awarded the National Flower Show gold medal. Its popularity was attested by the fact that it was the only exhibit where one-way traffic was necessary and where special guards were assigned to keep the crowds in order on Sundays.

NOTES

Mr. George H. Pring, Superintendent of the Garden, was a member of the committee of the National Flower Show, held in Louisville, March 10-18, and acted as a juror of awards.

Mr. George H. Pring spoke before the Collinsville High School, Collinsville, Illinois, March 1, on "Plant Collecting in Central America."

The January-February issue of Parks and Recreation con-

tains an article by Mr. L. P. Jensen, Arboriculturist to the Garden, on "Native Woody Plants of Unusual Adaptability."

Mr. L. P. Jensen spoke before the Kellogg Wild Flower Society at the St. Louis College of Pharmacy, February 17, on "The Flora of the Limestone Glades."

Dr. R. P. Strong, professor of tropical medicine, Harvard University Medical School, visited the Garden, en route from India. He commented very favorably on the appearance of the material in the tropical house.

The pitcher plants, flower spikes of Anthurium, nun orchids, and slipper orchids exhibited at the National Flower Show, at Louisville, were sent on to the North American Flower Show, held in Detroit, March 17-25.

Dr. George T. Moore, Director of the Garden, sailed on March 6, for an extended trip abroad, during which he will visit the leading botanical gardens and experiment stations of Europe, as well as the principal bulb and orchid growers.

Over 4,000 bulbs were used in staging the hyacinth show which occupied the floral display house the first part of March. The plants were arranged to represent a quaint Dutch garden, with picket fence and gravel paths. The appreciation of the public was very gratifying, and over 20,000 people visited the show during the two and one-half weeks it was in place.

Dr. Edgar Anderson, Geneticist to the Garden, has given the following talks recently: February 27, over Station WIL, on "A Plant Explorer"; March 8, before the Parent-Teachers Association of Glendale, and March 9, before the Webster Groves Nature Study Society, "Camping and Tramping in England"; March 13, before the Better Homes group of the Monday Club of Webster Groves, on "Garden Irises"; and March 14, before the Phi Sigma Biological Society, on "The Problem of Species."

In connection with the recent BULLETIN article on "An Unusual Bees' Nest," the following quotation, supplied by a correspondent, may be of general interest:

"The common honey bee readily becomes feral and then nearly always takes up its abode in hollow tree trunks. On very rare occasions, however, it suspends its combs in an ex-

posed situation from the branches of trees. The form and position of these combs are so much like those of certain species of Apis (*A. dorsata* and *A. florea*) in southern Asia, where the honey bee lived before it was domesticated and exported to temperate regions, that we are justified in interpreting this very unusual method of nidification as a return to ancestral conditions; in other words, as a renewal of a lingering or vestigal instinct, called forth by some unusual stimulus, such as the inability to find a suitable nesting cavity at the proper time and place.''—Wheeler, W. M., in Am. Jour. Psychology, Vol. 19, p. 4. 1908.

STATISTICAL INFORMATION FOR FEBRUARY, 1928

GARDEN ATTENDANCE:

Total number of visitors.....27,234

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 33
Total number of books and pamphlets donated..... 146

HERBARIUM ACCESSIONS:

By Purchase—

Epling, Dr. Carl C.—Photographs of herbarium type specimens 110
Gleason, Dr. H. A.—Plants of British Guiana..... 84
Heller, A. A.—Herbarium specimens of topotypes..... 100
Herter, Dr. Guillermo—Plants of Uruguay..... 125

By Gift—

Demaree, Professor Delzie—Plants of Arkansas..... 80
Grant, Mrs. Adele Lewis—Plants of California..... 34
Kellogg, John H.—Plants of Missouri..... 83
Koch, August—Plants of horticulture..... 5
Larsen, Miss Esther L.—Specimen of fungus from Montana 1
Linder, Dr. D. H.—Missouri fungi..... 4

By Exchange—

Masaryk University, Brno, Czechoslovakia, by Professor Joseph Podpêra—"Flora exsiccata Republicae Bohemicae Slovenicae," Series III, Nos. 201-300..... 100
University of Wisconsin, by Dr. N. C. Fassett—Plants of Eastern United States..... 137

Total 863

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Vandeventer avenue car line. Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
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GEORGE T. MOORE,
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Assistant to the Director

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Pathologist

ERNEST S. REYNOLDS,
Physiologist

JESSE M. GREENMAN,
Curator of Herbarium

DAVID H. LINDER,
Mycologist

EDGAR ANDERSON,
Geneticist

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Research Assistant

NELL C. HORNER,
Librarian and Editor of Publications

GEORGE H. PRING,
Superintendent

JOHN NOYES,
Landscape Designer

PAUL A. KOHL,
Floriculturist

ELINOR ALBERTS,
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Assistant Engineer

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H. VALLENTINE,
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GRAY SUMMIT EXTENSION

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Farm

D. MILLER,
Orchids

R. E. KISSECK,
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TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER,
Manager

MISSOURI BOTANICAL GARDEN BULLETIN

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MR. C. W. POWELL AT THE ENTRANCE TO HIS GARDEN.

Missouri Botanical Garden Bulletin

Vol. XVI APRIL, 1928 No. 4

CHARLES W. POWELL

At the request of Dr. George T. Moore, Director of the Garden, the following biography of Mr. C. W. Powell has been prepared by Mr. A. A. Hunter, who succeeded Mr. Powell as Manager of the Missouri Botanical Garden Tropical Station, Balboa, Canal Zone:

"Charles W. Powell was born November 5, 1854, at Richmond, Virginia. As a boy he was very fond of the water and was always found in its vicinity, despite the fact that his father was very much opposed to his being there. When Charles was only fourteen years old and his brother sixteen, the two boys ran away and tried to enlist in the Confederate Army. The commanding officer called a corporal of the guards and instructed him to take the two boys to the rear and administer a good spanking and send them home. This was as far as Charles participated in the activities of the war.

"During the war, and afterwards, the family was often deprived of the necessities of life, so much so that its daily diet was reduced to sweet potatoes and cucumbers. In later years Mr. Powell left these articles entirely out of his menu. The father was desirous of making a Methodist minister of his son, but this plan was entirely contrary to the boy's inclinations, and when he was sent to a religious school he ran away. He was then about eighteen years old. He was gone about two years without communicating with his parents, during which time he was engaged in ranching.

"At the age of twenty-one he moved to Memphis, Tennessee, and was employed in newspaper work. During his residence in Memphis he was married to Miss Adelaide Prince. Apart from his work he always found time for a hobby, his

first being stamp collecting. He secured a very complete collection of Confederate stamps, which he later sold to a stamp dealer for $2,500.00, at that time an enormous price—this was in the days before the $100.00-stamps.

"In 1885 he and his family, consisting of a wife and four daughters, moved to New Orleans. He was still in newspaper work, the particular branch being the accounting department. A little later we find him engaged as a cotton planter, during which time his wife died.

"During 1906 he decided that cotton planting was not to his liking, either financially or otherwise, and he set out on a journey to Guatemala on a visit to his daughter and son-in-law. It was while on this visit that he learned of the activities on the Isthmus of Panama where the work of building the Canal was just starting, and he set out for Panama. He disembarked from the old *S. S. San Juan*, of the Pacific Mail Line, at the old French town of La Boca. He was employed by the Isthmian Canal Commission as a quinine dispenser, stationed at the labor camp in old Gatun. From there he was transferred to Colon as hospital inspector, the duties of which position were to discover cases needing hospital treatment. To assist in this work he found it was necessary to understand the Spanish language, and so took up the study. In 1908 he was transferred to Porto Bello as dispensary assistant where he remained a little over a year. We find that his hobby has now changed to that of fishing. Without doubt his fishing hobby was at its height here, due partly to the fact of the favorable surroundings.

"It was here that I first became acquainted with Mr. Powell. A little pleasure party had gone to Porto Bello; we were on the American side of the Bay and wished to cross over to the old town of Pabello, of Morgan's time. There were no native boatmen with their cayucas here at this particular time, so that we were unable to get across until a row-boat was discovered near the dispensary. Upon inquiry we found that this boat belonged to Mr. Powell and he was willing for us to use it after giving implicit instructions to enable us to navigate the shallow water of the Bay. His instructions were so specific that we were unable to follow

them and we ran on to the coral reef—the very thing he had tried to prevent with his instructions. On our return we anchored the boat below the dispensary and then, contrary to his instructions, lost the anchor. We had to dive into the water to secure the anchor, which was accomplished just as Mr. Powell came around the corner.

"Early in 1910 Mr. Powell was transferred from Porto Bello to Gorgona as dispensary assistant. I had not met him since the boat incident. Inasmuch as I was a resident of Gorgona I very soon became well acquainted with him and joined him in his fishing trips, a large per cent of which were in the Panama Bay. Mr. Powell's prowess as a fisherman is best exemplified by his nickname which was given him by the local fishermen—'Pescadore Grande' (great fisherman). An experience on one of our first trips was in catching a blow fish, which was my first acquaintance with the 'animal.' A peculiar feature of this fish is that after it is caught it has a faculty of blowing itself up like a balloon. I became very much excited when I saw this performance and called to Mr. Powell that the fish was getting bigger and bigger all the time. He was well acquainted with the fish and was greatly amused at my consternation at the time.

"Later on our trips were transferred from the Panama Bay to the rising Gatun Lake. When sufficient water was available we purchased a motor boat, which happened to be the first motor boat to be used on the artificial lake. During our frequent fishing trips on the Lake we were brought into contact with the epiphtic growth upon the dying trees. This was destined to divert Mr. Powell's fishing interests to that of orchids. I remember quite well the first epiphytic plant collected was of the genus Phyllocactus, which found its home upon the porch of the dispensary at Gorgona. From now on interest was equally divided between fishing and finding vegetation upon the tree tops. At this time the water was rising sufficiently to kill the smaller trees, thus bringing one into closer contact with the orchids on the tops of the larger trees, which they mostly inhabited.

"On returning from one of our trips the boat was caught on a snag in the middle of the Chagres River, and in our

endeavor to dislodge it, was capsized and buckled against the snag. Mr. Powell had the anchor chain in his hands at the time when he found himself in deep water, and being unable to swim, he was pulled up to the boat by us and finally rescued by natives who came out in a cayuca. This experience did not curtail our activities, but rather increased them. We had the boat repaired and made into a better condition for trips on the Lake.

"On the final trip from Gorgona to Bohio we were accompanied by S. P. Virner, who conducted us to a large batch of dove orchids which were about to be submerged by the rising waters of the Chagres River. We were soon rewarded by a boat-load of the 'El Spirito Santo' which was brought back to Gorgona and from thence disseminated over the Canal Zone, the United States, and Europe. Mr. Powell's name of 'Pescadore Grande' was now changed to that of 'Parasita Grande.'

"About this time the level of the Lake was encroaching upon the old town of Gorgona (which is now at the bottom of Gatun Lake, 80 feet below the surface), and necessitated transferring the mechanical division headquarters to Balboa. It was not until late in 1915 that Mr. Powell began to think seriously of collecting orchids and establishing them on his porch. The motive that prompted him was to assemble a representative Panamanian collection to be taken to England where he contemplated making his home. His collection soon had outgrown the porch and he commandeered the space occupied by the clothes line. Up to this time his collection included only those indigenous to the Canal Zone. The rising level of the Lake now made it possible to collect easily all the orchids on the topmost branches of the largest trees. Such new species as *Maxillaria gatunensis*, *Sobralia Powellii*, *Epidendrum Powellii*, *Coryanthes Powellii*, *Coryanthes Hunteriana*, *Mormodes Powellii*, etc., were easily obtained. The collecting, however, became a perilous venture in view of the falling of decayed branches when in the act of removing the epiphytic growth. The collection now had outgrown the available porch space and was assembled in a small garden. The establishing of the garden was actuated by the act of Mrs. A.

H. Bryan presenting Mr. Powell with her collection of orchids, consisting of about a thousand plants, and a further donation by Charles H. Beetham.

"Mr. Powell's interest in the orchid now became extended to other localities and other species. His attention was called to the Chiriqui region, where we made collecting trips in 1918, 1920, and 1922. In 1924 I was unable to accompany him. This was his final trip to that region. During this trip Mr. Powell received a great amount of information and a number of new species through the activities of Mr. T. B. Moeniche, a former engineer of the Panama Canal, now living at the coffee finca at the foot of the Chiriqui volcano. Mr. Powell's last collecting trip was to the Santa Fe in Veraguas Province in March, 1925. The results were very poor, and I found the trip overtaxed his physical endurance and discouraged him from further attempts. During this trip the guide and I would have to lift him off the horse, due to the stiffening of his limbs, but after massaging had limbered him up, he would be ready to start for the coveted orchid again. In other words 'Pescadore Grande' was beginning to lose out in his limbs.

"It was in 1918 that he became interested in the taxonomy of orchids, at which time he wrote for assistance to Mr. R. A. Rolfe of the Royal Botanic Gardens, Kew, England. In July of this year Mr. Powell sent him his first dried plants, Nos. 2, 3, and 4. Further specimens were sent from time to time, but due to the ill health and sudden death of Mr. Rolfe no determinations were received. In August, 1920, Dr. R. Schlechter, of Berlin, Germany, took up the taxonomy of Panamanian orchids, and in 1922 published his first 'Orchidaceae Powellianae Panamenses.'

"In 1921 Mr. Powell made arrangements with Dr. Oakes Ames, of Harvard University, to take over the taxonomy of his collection. The original specimens which Mr. Powell had sent to Mr. Rolfe were forwarded from Kew to Dr. Ames.

On March 1, 1926, Mr. Powell entered into an agreement with the Missouri Botanical Garden, of St. Louis, to establish the Missouri Botanical Garden Tropical Station, with Mr. Powell as Manager. A new location of two and one-half acres of

land was given by The Panama Canal for the establishing of a new garden. Under Mr. Powell's direction the garden was laid out in 1927 and his collection moved from Morgan Avenue. A new residence was built by the Garden, where Mr. Powell resided just seventeen days when he died suddenly on August 18, 1927. Mr. Powell's orchid activities in Panama resulted in the discovery of 75 species new to science."

A DEPENDABLE SUMMER PERENNIAL

Few plants have been more appropriately named than the showy live-forever, *Sedum spectabile* Boreau. Be the summer wet or cold, or hot and dry, it grows on quite unconcernedly, throwing out its sprays of pink blossoms in late August or early September. It is not affected by late frosts in the spring or by hard freezes in the winter, and early April always finds its pert clusters of gray-green leaves rising up from the perennial beds before other plants are astir. Cutting the stalks does not wither the flowers. They bloom on quite as though they were still attached to the parental root, even though the stalk be pinned to the curtain in a sunny window. Making botanical specimens of the plant is a very real problem, for it is so fleshy that it is difficult to dry. Specimens will bravely go ahead in the press, putting out new leaves and shoots, sometimes showing signs of life after having been dried between blotters for six months.

Moreover, its hardiness is not its only recommendation. At all times of the year it is a trim and attractive plant. Its only drawback is the somewhat stiff aspect of the plant as a whole which keeps it from harmonizing well with the other plants of the perennial border. The leaves are thick, fleshy, and gray-green with a smooth waxy surface. New leaves appear at the base of the flower stalk before it dies in the fall, and gradually become more prominent during the winter and early spring. The stalk reaches a height of from one to two feet by the time it blossoms in the late summer. The flowers are a light rosy pink, harmonizing well with the gray-green of the leaves. The slender stamens, longer than the petals, are not in themselves conspicuous, but combine to give

SHOWY LIVE-FOREVER USED IN A PERENNIAL BORDER.

THE POTATO-TOMATO, ONE WEEK AFTER GRAFTING.

the flower an airy and graceful appearance. In addition to the ordinary form, there is a variety with deep purple flowers. It goes under various names, sometimes being known as variety *atropurpureum*, sometimes bearing simply the name "Brilliant".

The plant is simplicity itself when it comes to propagation. It can be increased rapidly either by dividing the root or by making cuttings. Division is best performed in the early spring when last year's plants may be broken up, leaving three or four buds on each of the new plants. By the end of the season each of these divisions will be a large thrifty plant and can be divided again the next spring. Cuttings can be made in a greenhouse bench, though such care is not usually necessary. The plant is so truly a live-forever that stalks, cut off from the plant in the early summer and planted firmly in ordinary garden soil, will usually root by the end of the season without any further preparation.

The cultivation of the plant presents no particular difficulties. It likes a well-drained soil and does not do its best in full shade. It is not attacked by insects and is not seriously troubled by plant diseases.

The slight stiffness which has been noted above suggested the use of the showy live-forever as a bedding plant, and during the past season it was tried out in the Italian Garden. The experiment was a complete success. The live-forever harmonized with the other bedding plants and had a special advantage over them in that it was hardy and did not have to be reset every year. Furthermore, the fresh, green color of the young leaves was attractive in the early spring when the rest of the garden was bare.

THE POTATO-TOMATO, A DUAL-PURPOSE PLANT

Though the plants which bear them are closely related, tomatoes and potatoes are very different in their development. The tomato is produced in the air, the potato in the ground. The former is a fruit in the strictly botanical sense, that is, it is the seed-bearing organ of the plant; the potato is merely a swollen bud on an underground stem. Tomato plants never bear tubers on *their* roots, but potatoes very often go

to seed and produce fruits which look not unlike small green tomatoes, though they are far from edible. Since the two vegetables are produced by different parts of the plant, we might hope, were we able to cross them, to produce a hybrid whose fruits would be edible and whose roots would bear potato-like tubers. Unfortunately the plants are not closely enough related to accomplish that, but we can get somewhat the same effect in a different way. We can graft the shoots of one on the roots of the other.

If, for instance, we take the buds out of a potato stem and replace them with buds from a tomato plant, we will obtain such a freakish individual as is shown in Plate 20. The potato shoot has been cut back and the tomato buds, healed in place, have started to grow. If they continue as did the plant in the picture, they will eventually produce a plant which will be like a tomato above the graft and like a potato below the graft. Two or three such plants are now on exhibit at the Missouri Botanical Garden and are a surprising sight with their tomatoes ripening in the air and their young potatoes already visible at the surface of the ground.

It is remarkable how completely the two tissues, that of the potato and that of the tomato, preserve their identity though so closely associated. There seems to be practically no influence of the one on the other. The potato roots remain like potato roots, and the underground stems produce perfectly ordinary potatoes as unconcernedly as if they had always been watched over by a tomato step-mother.

Though few people have seen such grafts, they are relatively easy to make and have been produced by a number of horticulturists. Apparently the first on record was that made over a century ago by one von Tschudy or De Tchudi, who reported his experiments to the Horticultural Institute at Fromont in France. While it is possible by means of such grafts to produce dual-purpose plants, the operation is of no practical importance. There is no way of perpetuating the potato-tomatoes, once they are formed, and the grafting must be performed anew for every plant which is produced.

THE POTATO-TOMATO IN FRUIT.

NOTES

Mr. Paul A. Kohl, Floriculturist to the Garden, spoke before the Carondelet Branch of the Young Men's Christian Association, March 30, on "Spring Gardening."

Dr. David H. Linder, Mycologist to the Garden, spoke at the Phi Sigma dinner, April 18, at the School of Medicine of Washington University, on "A Trip to British Guiana."

Word has been received from Dr. George T. Moore, Director of the Garden, that he addressed the students of the American University, in Cairo, Egypt, April 3, on "Some of the Activities of the Missouri Botanical Garden."

On their biennial inspection visits to libraries, printing establishments, etc., the students of the University of Illinois Library School visited the Garden, April 12, and were conducted through the library by members of the Garden staff.

Dr. Edgar Anderson, Geneticist to the Garden, spoke before the Webster Groves Nature Study Society, April 2, on "Spring Wild Flowers"; and gave a talk on plant life illustrated with moving pictures before the Woman's Chamber of Commerce, April 5.

Recent visitors to the Garden include Dr. A. P. Mathews, professor of physiological chemistry, University of Cincinnati; Dr. F. C. Vibrans, chemist, Procter and Gamble Co.; Dr. Edgar T. Wherry, of the Bureau of Chemistry, U. S. Department of Agriculture, Washington, D. C.

Dr. Hermann von Schrenk, Pathologist to the Garden, addressed the engineering faculty, University of Illinois, at Urbana, April 2, on "Problems of Engineering—A Biological Viewpoint"; and the civil engineering department, University of Illinois, April 3, on "Timber as an Engineering Material."

The Annual Flower Show of the Garden Club of St. Louis will be held in the Floral Display House at the Garden on May 19 and 20, and all amateur gardeners are urged to enter their exhibits. Flower lovers who have no gardens of their own may take an active part in the show by entering the competitions in flower arrangements which do not require the use of home-grown material.

Mr. George H. Pring, Superintendent of the Garden, has

given the following talks recently: March 27, before the Nashville Woman's Club, Nashville, Illinois, on "Orchid Exploration;" April 3, before the Men's Club of the Clifton Heights Presbyterian Church, on "The Missouri Botanical Garden Tropical Station, Panama"; April 6, before the pupils of the Yeatman High School, and April 11, before the pupils of the Normandy High School, on "Trees," in celebration of Arbor Day.

STATISTICAL INFORMATION FOR MARCH, 1928

GARDEN ATTENDANCE:

Total number of visitors	66,642

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	101
Total number of books and pamphlets donated	288

HERBARIUM ACCESSIONS:

By Purchase—

Broadway, W. E.—Plants of Trinidad	150
Graves, E. W.—Plants of the United States	1300
Mexia, Mrs. Ynez—Plants of Mexico	218
Migula, W.—"Cryptogamae Germaniae, Austriae et Helveticae exsiccatae." Fasc. 41-45 inclusive	150
Suksdorf, W. N.—Plants of Washington	314
Wenzel, C. A.—Plants of the Philippine Islands	300

By Gift—

Anderson, Dr. Edgar—Specimens of *Iris*	16
Demaree, Prof. Delzie—Plants of Arkansas	148
Goldsmith, G. W.—*Pluchea petiolata* Cass. from Louisiana	1
Hume, H. Harold—Plants of Florida	2
Larsen, Miss Esther—Mosses of Missouri	4
Mathias, Miss Mildred E.—Plants of Missouri	7
Pring, George H.—*Lycaste macrophylla* Lindl., from horticulture	1

By Exchange—

College of the Pacific, by Professor E. E. Stanford—Plants of California	100
Total	2711

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Vandeventer avenue car line. Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
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GARDEN OF MR. AND MRS. EUGENE H. ANGERT
SCENE IN TULIP GARDEN

Missouri Botanical Garden Bulletin

Vol. XVI MAY, 1928 No. 5

NOTABLE ST. LOUIS GARDENS

I. The Garden of Mr. and Mrs. Eugene H. Angert

Beginning with the present number, the Bulletin plans to publish articles on St. Louis gardens from time to time. The series will include all sorts and kinds of gardens, from large suburban estates to small back-yard plots in the city. Quite naturally the first article is devoted to the garden of Mr. and Mrs. Eugene H. Angert. For several years they have opened their garden to the public at tulip time, and it is probably more widely known than any other private garden in the St. Louis neighborhood.

The outstanding feature of the Angert garden is its spring display. Tulips, early iris, and lilacs have been provided with a lavish hand and planted in effective color combinations. Other flowers have been used to vary the picture and to complete the color symphony, but these three are dominant and the garden is at its best in those springs when they all flower at about the same time.

We have spoken of the Angert "garden"; gardens would be a more appropriate term, for there are really five of them, each with an air of its own, but all combining harmoniously. The largest, and the first to be seen on entering the grounds, is the perennial border which runs irregularly all around the south and west lawns. Backed by trees and shrubs, among which lilacs predominate, it contains a fascinating display of spring perennials and late tulips. At one point the border is broken by a group of pines among whose needles the dainty American dwarf iris (*Iris cristata*) is thoroughly at home and is spreading out vigorously—if anything so tiny can ever be referred to as vigorous. At another point

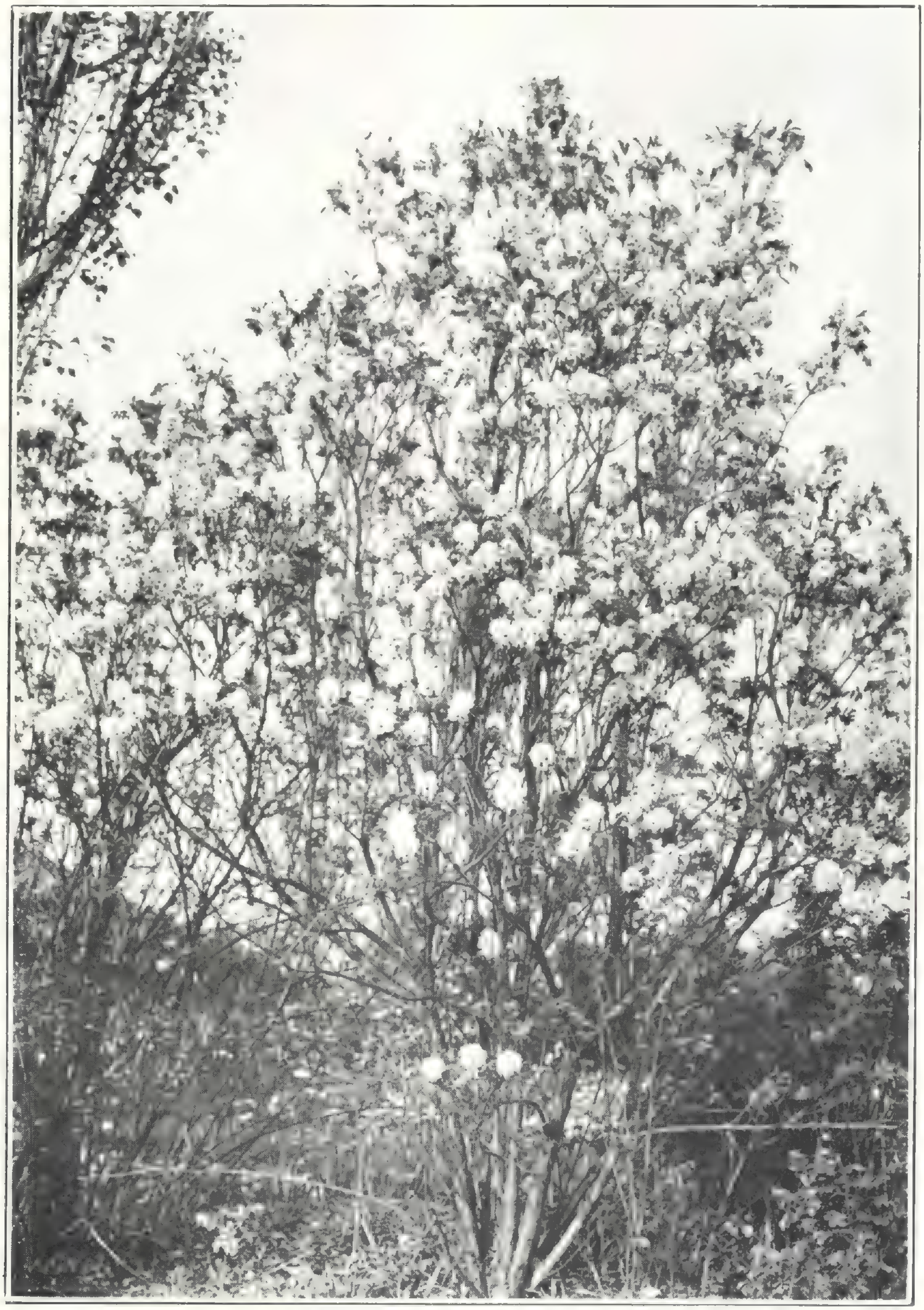
several particularly fine specimens of the flowering chestnut (*Xanthoceras sorbifolia*) form a striking background when covered with their racemes of showy white flowers.

The tulip garden is as hidden as the perennial border is conspicuous, being screened on all sides by a thick planting of shrubs and trees. In general plan it is like a theatre, and this effect is heightened when the flood lights are turned on in the evening. A fountain occupies what would be the stage, and the audience of tulips is arranged in semicircular beds which rise in several tiers. An informal border is built up with rough rocks at the base of the thick screen of shrubbery. Here are hidden away many rare and unusual flowers, hybrid narcissi, wild tulips, grape hyacinths, and the strangely streaked guinea-hen flower (*Fritillaria meleagris*).

From the tulip theatre it is just a step to the iris garden which lies on either side of a broad pathway leading to the wild garden. It is flanked by rows of dark native cedars, against which the bright colors of the tulips and irises show to best advantage. At one side a very unusual rock garden has recently been constructed and is already carpeted with mats of Sedum and other low-growing rock plants. Unlike most rock gardens it is formal in its general treatment and is built around a rectangular plot with a small pool in the center.

The wild garden, like the rock garden, is still too much in the process of construction to show to best advantage. It is already a thing of beauty, though only a promise of what it will become when the hemlocks and rhododendrons are well established. Blue and yellow are the predominating colors in this garden. The blue is furnished by Mertensia, by native Phlox, and by the lacy-flowered Phacelia; and the yellow by the common celandine (*Chelidonium majus*). Mr. Angert finds celandine to be a very useful subject in the wild garden, as it multiplies rapidly in such an environment and fills in any bare spots.

From his experience Mr. Angert makes a number of other recommendations which will be of interest to St. Louis gardeners. Of all the tulips he finds the variety "Picotee" or "Maiden's Blush" the most thoroughly reliable for St. Louis.



XANTHOCERAS SORBIFOLIA

GARDEN OF MR. AND MRS. E. H. ANGERT
PATH THROUGH THE WILD GARDEN

It comes up year after year, and requires no further attention after it has once been planted, whereas most of the other varieties need to be replanted every second year unless specially treated. The guinea-hen flower (*Fritillaria meleagris*) is another spring bulb which does well here and does not need to be replaced. The old-fashioned grape hyacinths are likewise dependable, increasing from year to year and requiring little attention. More surprising is Mr. Angert's experience with Polyanthus primroses. Although they are supposed to be somewhat difficult in this climate, he finds them superior to some of the commoner bedding plants and many of them have wintered over without protection.

Such experiences make one realize that gardening in our sun-baked and blizzard-blown Middle West is truly in its infancy. Only until a few more generations of gardeners have tried and failed and tried again will the best garden flowers for our difficult climate have been found.

CHECK-LIST OF THE FERNS AND FLOWERING PLANTS INDIGENOUS TO THE MISSOURI BOTANICAL GARDEN EXTENSION, GRAY SUMMIT, MISSOURI

The following preliminary check-list of ferns and flowering plants native to the Missouri Botanical Garden Extension, at Gray Summit, Missouri, has been prepared for use until a more complete flora can be assembled. The scientific names are given in accordance with the rules of the International Code, and the order of families follow that of the seventh edition of Gray's "Manual".

1. POLYPODIACEAE (Polypody Family).

Adiantum pedatum L. Maidenhair fern.
Asplenium platyneuron (L.) Oakes. Ebony spleenwort.
Asplenium Trichomanes L. Maiden-hair spleenwort.
Cheilanthes Feèi Moore. Fee's lip-fern.
Cystopteris fragilis (L.) Bernh. Brittle fern.

Pellaea atropurpurea (L.) Link. Purple-stemmed cliff-brake.
Phegopteris hexagonoptera (Michx.) Fee. Broad beech-fern.
Polystichum acrostichoides (Michx.) Schott. Christmas fern.
Woodsia obtusa (Spreng.) Torr. Blunt-lobed woodsia.

2. OPHIOGLOSSACEAE (Adder's-tongue Family).
Botrychium ternatum (Thunb.) Sw. Ternate grape-fern.
Botrychium virginianum (L.) Sw. Virginia grape-fern.

3. EQUISITACEAE (Horsetail Family).
Equisetum hyemale var. *robustum* (A. Br.) A. A. Eaton. Stout scouring-rush.

4. PINACEAE (Pine Family).
Juniperus virginiana L. Red Cedar.

5. TYPHACEAE (Cattail Family).
Typha latifolia L. Broad-leaved cat-tail.

6. NAJADACEAE (Pondweed Family).
Potamogeton hybridus Raf. Rafinesque's pondweed.

7. ALISMACEAE (Water-plantain Family).
Sagittaria latifolia Willd. Broad-leaved arrow-head.

8. GRAMINEAE (Grass Family).
Agrostis alba L. Red-top.
Agrostis hyemalis (Walt.) BSP. Rough hair-grass.
Agrostis perennans (Walt.) Tuckerm. Thin grass.
Alopecurus geniculatus L. Marsh foxtail.
Andropogon Elliottii Chapm. Elliott's beard-grass.
Andropogon furcatus Muhl. Forked beard-grass.
Andropogon scoparius Michx. Broom beard-grass.
Aristida basiramea Engelm. Forked aristida.
Aristida oligantha Michx. Few-flowered aristida.
Asprella Hystrix Willd. Bottle-brush grass.
Bouteloua curtipendula (Michx.) Torr. Racemed bouteloua.
Brachyelytrum erectum (Schreb.) Beauv. Brachyelytrum.
Bromus ciliatus L. Fringed brome-grass.
Bromus racemosus L. Smooth brome-grass.
Bromus secalinus L. Cheat or chess.
Cinna arundinacea L. Wood reed-grass
Dactylis glomerata L. Orchard grass.
Danthonia spicata (L.) Beauv. Common wild oats.
Diarrhena diandra Michx. Diarrhena.
Digitaria filiformis (L.) Koeler. Slender finger-grass.
Digitaria sanguinalis (L.) Scop. Crab-grass.
Echinochloa crusgalli (L.) Beauv. Barnyard grass.
Eleusine indica (L.) Gaertn. Wire grass.
Elymus canadensis L. Nodding wild rye.
Elymus striatus Willd. Slender wild rye.
Elymus virginicus L. Virginia wild rye.
Eragrostis Frankii (Fisch, Mey. & Lall.) Steud. Frank's eragrostis.

Eragrostis hypnoides (Lam.) BSP. Creeping eragrostis.
Eragrostis interrupta Trelease. Clustered eragrostis.
Eragrostis megastachya (Koeler) Link. Strong-scented eragrostis.
Eragrostis pectinacea Steud. Purple eragrostis.
Eragrostis pectinacea var. *spectabilis* Gray. Eragrostis.
Eragrostis pilosa (L.) Beauv. Tufted eragrostis.
Festuca Shortii Kunth. Short's fesque grass.
Glyceria nervata (Willd.) Trin. Nerved manna grass.
Hordeum jubatum L. Squirrel-tail grass.
Hordeum nodosum L. Meadow barley.
Koeleria cristata (L.) Pers. Koeleria.
Leersia oryzoides (L.) Sw. Rice cut-grass.
Leersia virginica Willd. White grass.
Leptoloma cognatum (Schultes) Chase. Fall witch grass.
Melica mutica Walt. Narrow melic grass.
Muhlenbergia mexicana (L.) Trin. Meadow muhlenbergia.
Muhlenbergia racemosa (Michx.) BSP. Marsh muhlenbergia.
Muhlenbergia Schreberi J. F. Gmel. Drop seed.
Muhlenbergia sobolifera (Muhl.) Trin. Rock muhlenbergia.
Muhlenbergia sylvatica Torr. Wood muhlenbergia.
Muhlenbergia tenuiflora (Willd.) BSP. Slender muhlenbergia.
Panicum anceps Michx. Beaked panicum.
Panicum Boscii Poir. Panicum.
Panicum capillare L. Tumble-weed.
Panicum clandestinum L. Hispid panicum.
Panicum depauperatum Muhl. Starved panicum.
Panicum dichotomum L. Forked panicum.
Panicum dichotomiflorum Michx. Spreading panicum.
Panicum huachucae Ashe. Panicum.
Panicum lanuginosum Ell. Hairy panicum.
Panicum latifolium L. Large-fruited panicum.
Panicum microcarpon Muhl. Small-fruited panicum.
Panicum perlongum Nash. Panicum.
Panicum polyanthes Schultes. Panicum.
Panicum scoparium Lam. Panicum.
Panicum virgatum L. Tall smooth panicum.
Paspalum setaceum Michx. Slender paspalum.
Phleum pratense L. Timothy.
Poa annua L. Annual meadow grass.
Poa autumnalis Muhl. Flexuous spear grass.
Poa Chapmaniana Scribn. Chapman's spear grass.
Poa compressa L. Flat-stemmed meadow grass.
Poa pratensis L. Kentucky blue grass.
Poa sylvestris Gray. Sylvan spear grass.
Setaria glauca Beauv. Yellow foxtail.
Setaria verticillata Beauv. Foxtail grass.
Setaria viridis Beauv. Green foxtail grass.
Sorghastrum nutans (L.) Nash. Indian grass.

Sphenopholis pallens (Spreng.) Scribn. Sphenopholis.
Sporobolus asper (Michx.) Kunth. Rough rush-grass.
Sporobolus heterolepis Gray. Northern dropseed.
Sporobolus minor Vasey. Sheathed rush-grass.
Sporobolus vaginiflorus Vasey. Small rush-grass.
Tridens flavus (L.) Hitchc. Tall red top.
Tripsacum dactyloides L. Gama grass.
Uniola latifolia L. Broad-leaved spike-grass.

9. CYPERACEAE (Sedge Family).
Carex cephalophora Muhl. Oval-headed sedge.
Carex conjuncta Boott. Soft fox sedge.
Carex Crawei Dewey. Crawe's sedge.
Carex Davisii Schwein. & Torr. Davis' sedge.
Carex eburnea Boott. Bristle-leaved sedge.
Carex festucacea var. *brevior* (Dewey) Fernald. Fesque sedge.
Carex Frankii Kunth. Frank's sedge.
Carex glaucodea Tuckerm. Glaucescent sedge.
Carex granularis Muhl. Meadow sedge.
Carex grisea Wahlenb. Gray sedge.
Carex Jamesii Schwein. James' sedge.
Carex laxiflora Lam. Loose-flowered sedge.
Carex laxiflora var. *latifolia* Boott. Sedge.
Carex laxiflora var. *patulifolia* (Dewey) Carey. Sedge.
Carex Muhlenbergii Schkuhr. Muhlenberg's sedge.
Carex oligocarpa Schkuhr. Few-fruited sedge.
Carex pennsylvanica Lam. Pensylvania sedge.
Carex riparia W. Curtis. River-bank sedge.
Carex rosea Schkuhr. Stellate sedge.
Carex Shortiana Dewey. Short's sedge.
Carex sparganioides Muhl. Bur-reed sedge.
Carex stipata Muhl. Awl-fruited sedge.
Carex straminea Willd. Straw sedge.
Carex tribuloides Wahlenb. Blunt broom sedge.
Carex triceps Michx. Hirsute sedge.
Carex triceps var. *Smithii* Porter. Carolina sedge.
Carex umbellata Schkuhr. Umbel-like sedge.
Carex varia Muhl. Fibrous-rooted sedge.
Carex vulpinoidea Michx. Fox sedge.
Cyperus erythrorhizos Muhl. Red-rooted cyperus.
Cyperus esculentus L. Yellow nut-grass.
Cyperus ovularis (Michx.) Torr. Globose cyperus.
Cyperus rivularis Kunth. Shining cyperus.
Eleocharis acicularis (L.) R.&S. Needle spike-rush.
Eleocharis Engelmanni Steud. Engelmann's spike-rush.
Eleocharis ovata (Roth) R.&S. Ovoid spike-rush.
Eleocharis palustris (L.) R.&S. Creeping spike-rush.
Fimbristylis castanea Michx. Marsh fimbristylis.
Kyllinga pumila Michx. Low kyllinga.
Scirpus americanus Pers. Chair-maker's rush.

Scirpus atrovirens Muhl. Dark-green bulrush.
Scirpus lineatus Michx. Reddish bulrush.

10. ARACEAE (Arum Family).
Acorus Calamus L. Sweet flag.
Arisaema Dracontium (L.) Schott. Green dragon.
Arisaema triphyllum (L.) Schott. Jack-in-the-pulpit. Indian turnip.

11. LEMNACEAE (Duckweed Family).
Lemna minor L. Lesser duckweed.

12. COMMELINACEAE (Spiderwort Family).
Commelina virginica L. Virginia day-flower.
Tradescantia virginiana L. Spiderwort.

13. JUNCACEAE (Rush Family).
Juncus acuminatus Michx. Sharp-fruited rush.
Juncus effusus L. Common rush.
Juncus marginatus Rostk. Grass-leaved rush.
Juncus tenuis Willd. Slender rush.
Luzula campestris DC. Common wood-rush.

14. LILIACEAE (Lily Family).
Allium canadense L. Meadow garlic.
Allium cernuum Roth. Nodding wild onion.
Allium stellatum Ker. Prairie wild onion.
Allium vineale L. Field garlic.
Asparagus officinalis L. Asparagus.
Camassia esculenta (Ker) Robinson. Wild hyacinth.
Erythronium albidum Nutt. White adder's-tongue.
Erythronium mesochoreum Knerr. Midland adder's-tongue.
Nothoscordum bivalve (L.) Britton. Yellow false garlic.
Polygonatum commutatum (R.&S.) Dietr. Smooth Solomon's seal.
Smilacina racemosa (L.) Desf. False Solomon's seal.
Smilax ecirrhata (Engelm.) S. Wats. Upright smilax.
Smilax herbacea L. Carrion flower.
Smilax hispida Muhl. Hispid green-brier.
Trillium recurvatum Beck. Prairie wake-robin.
Trillium sessile L. Sessile-flowered wake-robin.
Uvularia perfoliata L. Perfoliate bellwort.

15. AMARYLLIDACEAE (Amaryllis Family).
Hypoxis hirsuta (L.) Coville. Star grass.

16. DIOSCOREACEAE (Yam Family).
Dioscorea villosa L. Wild yam-root.

17. IRIDACEAE (Iris Family).
Nemastylis acuta (Bart.) Herb. Northern nemastylis.
Sisyrinchium angustifolium Mill. Pointed blue-eyed grass.
Sisyrinchium albidum Raf. Pale blue-eyed grass.

18. ORCHIDACEAE (Orchid Family).
Spiranthes cernua (L.) Richard. Nodding ladies' tresses.

19. SALICACEAE (Willow Family).
Populus deltoides Marsh. Cottonwood.
Salix cordata Muhl. Heart-leaved willow.
Salix longifolia Muhl. Sand-bar willow.
Salix nigra Marsh. Black willow.
Salix Wardi Bebb. Ward's willow.

20. JUGLANDACEAE (Walnut Family).
Juglans cinerea L. Butternut.
Juglans nigra L. Black walnut.
Carya alba (L.) K. Koch. Mocker nut.
Carya cordiformis (Wang.) K. Koch. Bitter nut.
Carya glabra (Mill.) Spach. Pignut.
Carya laciniosa (Michx.f.) Loud. Big shell-bark hickory.

21. BETULACEAE (Birch Family).
Betula nigra L. Red birch, river birch.
Carpinus caroliniana Walt. Hornbeam, ironwood.
Corylus americana Walt. Hazelnut.
Ostrya virginiana (Mill.) K. Koch. Hop hornbeam.

22. FAGACEAE (Beech Family).
Castanea dentata (Tourn.) Hill. American chestnut.
Quercus alba L. White oak.
Quercus bicolor Willd. Swamp white oak.
Quercus coccinea Muench. Scarlet oak.
Quercus imbricaria Michx. Shingle oak, laurel oak.
Quercus macrocarpa Michx. Bur oak.
Quercus marilandica Muench. Black Jack.
Quercus Muhlenbergii Engelm. Chestnut oak.
Quercus palustris Muench. Pin oak.
Quercus rubra L. Red oak.
Quercus stellata Wang. Post oak.

23. ULMACEAE (Elm Family).
Celtis occidentalis L. Hackberry, sugarberry.
Celtis occidentalis var. *pumila* Muhl. Dwarf hackberry.
Ulmus americana L. American elm, white elm.
Ulmus fulva Michx. Slippery elm, red elm.

24. MORACEAE (Mulberry Family).
Humulus Lupulus L. Common hop.
Morus rubra L. Red mulberry.

25. URTICACEAE (Nettle Family).
Laportea canadensis (L.) Gaud. Wood nettle.
Parietaria pennsylvanica Muhl. Pennsylvania pellitory.
Pilea pumila Gray. Clearweed.

26. SANTALACEAE (Sandalwood Family).
Comandra umbellata (L.) Nutt. Bastard toad-flax.

27. ARISTOLOCHIACEAE (Birthwort Family).
Aristolochia Serpentaria L. Virginia snakeroot.
Asarum canadense L. Wild ginger.

28. POLYGONACEAE (Buckwheat Family).
Polygonum aviculare L. Knot-grass.
Polygonum hydropiperoides Michx. Mild water pepper.
Polygonum lapathifolium L. Pale persicaria.
Polygonum pennsylvanicum L. Pennsylvania persicaria.
Polygonum scandens L. Climbing false buckwheat.
Polygonum tenue Michx Slender knotweed.
Polygonum virginianum L. Virginia knotweed.
Rumex Acetosella L. Sheep sorrel.
Rumex altissimus Wood. Tall dock.
Rumex crispus L. Curled dock.
Rumex mexicanus Meisn. Mexican dock.
Rumex obtusifolius L. Bitter dock.

29. CHENOPODIACEAE (Goosefoot Family).
Chenopodium album L. Pigweed.
Chenopodium ambrosioides L. Mexican tea.
Chenopodium hybridum L. Maple-leaved goosefoot.

30. AMARANTHACEAE (Amaranth Family).
Amaranthus blitoides Wats. Prostrate amaranth.
Amaranthus graecizans L. Tumble weed.
Amaranthus paniculatus L. Purple amaranth.
Amaranthus retroflexus L. Green amaranth.
Amaranthus spinosus L. Thorny amaranth.
Iresine paniculata (L.) Ktze. Blood-leaf.

31. PHYTOLACCACEAE (Pokeweed Family).
Phytolacca decandra L. Pokeweed.

32. NYCTAGINACEAE (Four-o'clock Family).
Oxybaphus nyctagineus (Michx.) Sweet. Heart-leaved umbrella-wort.

33. ILLECEBRACEAE (Knotwort Family).
Anychia canadensis (L.) BSP. Forked Chickweed.

34. AIZOACEAE (Carpet Weed Family).
Mollugo verticillata L. Carpet weed.

35. CARYOPHYLLACEAE (Pink Family).
Agrostemma Githago L. Corn cockle.
Arenaria stricta Michx. Rock sandwort.
Arenaria patula Michx. Pitcher's sandwort.
Cerastium arvense L. Field mouse-ear chickweed.
Cerastium nutans Raf. Nodding chickweed.
Sagina decumbens (Ell.) T.&G. Decumbent pearlwort.
Silene antirrhina L. Sleepy catchfly.
Silene latifolia (Mill.) Britten & Rendle. Bladder campion.
Silene stellata (L.) Ait.f. Starry campion.
Saponaria officinalis L. Bouncing Bet.

36. PORTULACACEAE (Purslane Family).
Claytonia virginica L. Spring beauty.
Portulaca oleracea L. Purslane.

37. RANUNCULACEAE (Crowfoot Family).
Anemone caroliniana Walt. Carolina anemone.
Anemone virginiana L. Tall anemone.
Anemonella thalictroides (L.) Spach. Rue anemone.
Aquilegia canadensis L. Wild columbine.
Clematis Pitcheri T.&G. Pitcher's clematis.
Clematis virginiana L. Virginia virgin's bower.
Delphinium azureum Michx. Carolina larkspur.
Delphinium tricorne Michx. Dwarf larkspur.
Hydrastis canadensis L. Golden seal.
Isopyrum biternatum (Raf.) T.&G. False rue anemone.
Myosurus minimus L. Mouse-tail.
Ranunculus abortivus L. Kidney-leaved crowfoot.
Ranunculus micranthus Nutt. Rock crowfoot.
Ranunculus fascicularis Muhl. Early buttercup.
Ranunculus Harveyi (Gray) Britton. Harvey's buttercup.
Ranunculus hispidus Michx. Hispid buttercup.
Ranunculus septentrionalis Poir. Swamp buttercup.

38. ANONACEAE (Custard Apple Family).
Asimina triloba Dunal. North American papaw.

39. MENISPERMACEAE (Moonseed Family).
Calycocarpum Lyoni (Pursh.) Nutt. Cupseed.
Menispermum canadense L. Moonseed.

40. BERBERIDACEAE (Barberry Family).
Podophyllum peltatum L. May apple.

41. LAURACEAE (Laurel Family).
Benzoin aestivale (L.) Nees. Wild allspice.
Sassafras variifolium (Salisb.) Ktze. Sassafras.

42. PAPAVERACEAE (Poppy Family).
Sanguinaria canadensis L. Bloodroot.

43. FUMARIACEAE (Fumitory Family).
Dicentra Cucullaria (L.) Bernh. Dutchman's breeches.
Corydalis aurea Willd. Golden corydalis.

44. CRUCIFERAE (Mustard Family).
Arabis canadensis L. Sickle-pod.
Arabis dentata T.&G. Toothed rock cress.
Arabis hirsuta (L.) Scop. Hairy rock cress.
Arabis laevigata (Muhl.) Poir. Smooth rock cress.
Arabis virginica (L.) Trelease. Virginia rock cress.
Brassica alba (L.) Boiss. White mustard.
Capsella Bursa-pastoris (L.) Medic. Shepherd's purse.
Cardamine hirsuta L. Hairy bitter cress.
Dentaria laciniata Muhl. Cut-leaved toothwort.
Draba brachycarpa Nutt. Short-fruited whitlow grass.
Draba caroliniana Walt. Carolina whitlow grass.
Draba cuneifolia Nutt. Wedge-leaved whitlow grass.
Iodanthus pinnatifidus (Michx.) Steud. Purple pocket.

Leavenworthia uniflora Michx. Michaux's leavenworthia.
Lepidium virginicum L. Wild peppergrass.
Radicula palustris (L.) Moench. Yellow water cress.
Sisymbrium canescens Nutt. Tansy mustard.
Sisymbrium officinale (L.) Scop. Hedge mustard.

45. CRASSULACEAE (Orpine Family).
Penthorum sedoides L. Ditch stonecrop.

46. SAXIFRAGACEAE (Saxifrage Family).
Heuchera hirsuticaulis (Wheelock) Rydb. Rough heuchera.
Hydrangea arborescens L. Wild hydrangea.
Ribes gracile Michx. Missouri gooseberry.

47. PLATANACEAE (Plane Tree Family).
Platanus occidentalis L. Sycamore, buttonwood.

48. ROSACEAE (Rose Family).
Agrimonia gryposepala Wallr. Tall hairy agrimony.
Agrimonia parviflora Ait. Many-flowered agrimony.
Amelanchier canadensis (L.) Medic. Service berry.
Aruncus sylvester Kosteletzsky. Goat's beard.
Crataegus Engelmanni Sarg. Engelmann's hawthorn.
Crataegus pruinosa (Wendl.) C. Koch. hawthorn.
Crataegus tomentosa L. Pear haw.
Fragaria virginiana Duchesne. Wild strawberry.
Geum canadense Jacq. White avens.
Geum vernum (Raf.) T.&G. Spring avens.
Gillenia stipulata (Muhl.) Trelease. American ipecac.
Physocarpus opulifolius (L.) Maxim. Nine-bark.
Potentilla canadensis L. Five-finger.
Potentilla paradoxa Nutt. Bushy cinquefoil.
Prunus americana Marsh. Wild plum.
Prunus serotina Ehrh. Wild black cherry.
Pyrus coronaria L. American crab.
Rosa blanda Ait. Meadow rose.
Rosa humilis Marsh. Pasture rose.
Rosa setigera Michx. Prairie rose.
Rubus canadensis L. Dewberry.
Rubus occidentalis L. Black raspberry.
Rubus villosus Ait. High-bush blackberry.

49. LEGUMINOSAE (Pea Family).
Amorpha canescens Pursh. Lead plant.
Amphicarpa monoica (L.) Ell. Hog peanut.
Amphicarpa Pitcheri T.&G. Pitchers hog peanut.
Apios tuberosa Moench. Groundnut.
Astragalus distortus T. & G. Bent milk vetch.
Astragalus mexicanus A. DC. Larger ground plum.
Astragalus canadensis L. Milk vetch.
Cassia Chamaecrista L. Partridge pea.
Cassia Medsgeri Shafer. Wild senna.
Cercis canadensis L. Redbud. Judas tree.

Desmodium bracteosum (Michx.) DC. Large-bracted tick-trefoil.
Desmodium Dillenii Darl. Dillen's tick-trefoil.
Desmodium grandiflorum (Walt.) DC. Pointed-leaved tick-trefoil.
Desmodium laevigatum (Nutt.) DC. Smooth tick-trefoil.
Desmodium nudiflorum (L.) DC. Naked-flowered tick-trefoil.
Desmodium paniculatum (L.) DC. Panicled tick-trefoil.
Desmodium rotundifolium (Michx.) DC. Prostrate tick-trefoil.
Gleditsia triacanthos L. Honey locust.
Gleditsia triacanthos var. *enermis* Pursh. Thornless honey locust.
Gymnocladus dioica (L.) Koch. Kentucky coffee-tree.
Lespedeza capitata Michx. Round-headed bush-clover.
Lespedeza Manniana Mackenzie & Bush. Mann's tick-trefoil.
Lespedeza procumbens Michx. Trailing bush-clover.
Lespedeza striata (Thunb.) H. & A. Japan clover.
Lespedeza violacea (L.) Pers. Violet bush-clover.
Medicago sativa L. Alfalfa.
Melilotus alba Desr. Sweet clover.
Melilotus officinalis (L.) Lam. Yellow sweet clover.
Petalostemum candidum Michx. White prairie clover.
Petalostemum purpureum (Vent.) Rydb. Purple prairie clover.
Psoralea tenuiflora Pursh. Few-flowered psoralea.
Psoralea Onobrychis Nutt. Sainfoin psoralea.
Strophostyles helvola (L.) Britton. Trailing wild bean.
Strophostyles pauciflora (Benth.) Wats. Small wild bean.
Stylosanthes biflora var. *hispidissima* (Michx.) Pollard & Ball. Pencil flower.
Tephrosia virginiana (L.) Pers. Goat's rue.
Trifolium hybridum L. Alsike clover.
Trifolium pratense L. Red clover.
Trifolium repens L. White clover.

(To be continued)

THE GARDEN'S EXHIBIT AT THE NATIONAL ORCHID SHOW

The exhibit of the Missouri Botanical Garden at the National Orchid Show, held in New York City, May 10-12, filled 700 square feet at the Madison Square Garden. A large part of the space was occupied by the orchids shipped to New York for this purpose from the Tropical Station, at Panama. Twenty-four distinct species were included in this exhibit which was arranged in a setting to simulate their native jungle. The floor was covered with peat; a screen of huckle-

berry branches formed the background; and palms, ferns etc., were used as decoration and to separate the booths. The trunks of trees were used on which to display some of the epiphytic orchids, but the majority were shown attached to the logs on which they were growing in the jungle.

The central feature of the exhibit was the flowering Cypripediums from the Gray Summit Extension. On the right of these was the collection of Nepenthes, or pitcher plants, suspended in baskets, which attracted a great amount of attention on account of their novelty. *Nepenthes Dyeriana,* the largest variety, has pitchers capable of holding a pint of water. On the left was a display illustrating the development of orchids from seed to flowering plant. Oncidiums in full bloom from the Garden Extension at Gray Summit formed a part of the exhibit.

The Garden was awarded a special silver medal for the Cypripedium exhibit; a gold medal for the Nepenthes; a gold medal for the collection from Central America; a gold medal for the exhibit illustrating the development of orchids from seed to flowering plant, also a special gold medal for this exhibit as the orchid exhibit of highest educational value, from the Horticultural Society of New York.

NOTES

Mr. George H. Pring, Superintendent of the Garden, acted as one of the judges of the National Orchid Show, held at Madison Square Garden, New York City, May 10-12.

The members of the St. Louis Horticultural Society were guests of the Garden at the Gray Summit Extension, May 27.

Mr. L. P. Jensen, Arboriculturist to the Garden, is the author of an article in the March-April issue of Parks and Recreation on "Naturalizing Native Plants."

Dr. Hermann von Schrenk, Pathologist to the Garden, gave a talk before the South Side Lions Club, May 8, on "Gardening"; and one before the St. Louis Horticultural Society, May 11, on "Transplanting Trees and Shrubs."

Mr. L. P. Jensen spoke before the St. Louis Horticultural

Society, at the Washington University School of Medicine, May 3, on "Native Plants."

Mr. George H. Pring, spoke at the meeting of the St. Louis Association of Gardeners, May 2, on "The Missouri Botanical Garden Tropical Station, Balboa"; and before the North Side Optimists Club, at the North Side Y. M. C. A., May 24, on "Orchid Exploration."

Professor H. W. Rickett, Assistant Professor of Botany, University of Missouri, was in charge of a party from the University of Missouri, consisting of assistants in botany, graduate students, and the class in taxonomy which visited the Garden, May 12. Following a trip through the Garden, a luncheon was served, and the party was shown through the herbarium and the library.

Among those visiting the Garden recently were Dr. Otto Dorner, of Essen, Germany, and Miss Mara Typke, of Berlin, who were in the party of German educators visiting St. Louis; the senior class in landscape architecture from the University of Illinois; and Dr. B. M. Duggar, Professor of Physiological and Applied Botany, University of Wisconsin.

A party of Mexican librarians, in charge of Mrs. Maud D. Sullivan, Librarian of the El Paso Public Library, Texas, visited in St. Louis, May 18, and were brought to the Garden library by Dr. Arthur E. Bostwick, Librarian of the St. Louis Public Library, to see the old herbals and rare botanical works. The members of the party were: Senorita Esperanza Velasquez Bringas, Chief of the Library Department of the Ministry of Education, Mexico City; Senor Joaquin Mendez Rivas, Director of the National Library, Mexico City; Senor Rafael Heliodoro Valle, of the Library Department, Ministry of Education, Mexico City; Senor Joaquin Diaz Mercado, Librarian of the Library of the Ministry of Education, Mexico City; Senor Rafael Aguilar y Santillan, Perpetual Secretary of the Sociedad Cientifica Antonio Alzate, Mexico City; and Senor Tobias Chavez, Director of the University of Mexico libraries, Mexico City.

The first number of Volume 15 of the Annals of the Missouri Botanical Garden appeared on April 30 and contained the following articles:

"A New Genus of the Acanthaceae," Clarence E. Kobuski.

"A Monograph of the American Species of the Genus Dyschoriste," Clarence E. Kobuski.

"Studies in the Umbelliferae, I." Mildred E. Mathias.

"Concerning the Status of the Genus Laternea," David H. Linder.

Dr. Kobuski, who is now an Assistant in the Arnold Arboretum of Harvard University, was formerly Rufus J. Lackland Fellow in the Henry Shaw School of Botany, and his papers report work done by him at that time. They are concerned with the classification and naming of a group of plants in the Acanthus family, native to the Southern United States, Central, and South America.

Miss Mathias, Jessie R. Barr Research Fellow in the Henry Shaw School of Botany, is publishing the first of a series of papers on the Parsley family. It concerns the genus Glehnia, which is native to the coasts of eastern Asia and western America. The first studies of these plants were made by isolated workers in Germany Russia, England, Japan, and the United States, who were not well acquainted with each other's work, so that in some instances the same plants were described under different names. There has been much resultant confusion and it has been Miss Mathias' task to clarify the situation.

Dr. Linder's paper concerns a genus of fungi closely related to the so-called "stink horns." A careful examination of material which he collected in Cuba has enabled him more clearly to define the group and to show its exact relationship to closely allied genera.

STATISTICAL INFORMATION FOR APRIL, 1928

GARDEN ATTENDANCE:

Total number of visitors.....25,833

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 55
Total number of books and pamphlets donated..... 290

HERBARIUM ACCESSIONS:

By Purchase—

Botanical Garden and Museum, Berlin, Germany—Plants of Bolivia collected by Dr. J. Steinbach..... 200
Epling, Dr. Carl C.—Photographs of type specimens..... 352

By Gift—

Anderson, Dr. E.—Seeds of *Iris versicolor* L..... 1
Benke, H. C.—Plants of Texas and Missouri..... 8
Braun, Miss E. Lucy—Plants of Ohio..... 12
Brewer, Mrs. J. E.—*Magnolia* sp. from horticulture..... 1
Henderson, Miss Lena—*Setaria verticillata* (L.) Beauv. from Illinois 1
Hunter, A. A.—Plants of Canal Zone, Panama..... 53
Kellogg, John H.—Plants of Missouri..... 8
Mathias, Mildred E.—*Conium maculatum* L. from Kansas 1
Roush, Mrs. Eva M. Fling—Mosses of Missouri..... 2

By Exchange—

University of Montreal, by Professor Marie-Victorin—Plants, mainly from Anticosti, Canada..... 36

Total 675

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Vandeventer avenue car line. Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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MISSOURI BOTANICAL GARDEN BULLETIN

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BRASSOCATTLEYA LOTOS

Missouri Botanical Garden Bulletin

Vol. XVI JUNE, 1928 No. 6

FRAGRANT HERBS IN THE MEDICINAL GARDEN

Although few of the plants in the medicinal plant garden are beautiful, nearly every one has a decided odor. As one starts down the path that leads toward it from the floral display house he is met half way by a pleasant mixture of curious smells. Marjoram, basil, and camomile are the most prominent, but blended with them are a host of lesser ones, for the medicinal garden, established in co-operation with the St. Louis College of Pharmacy, is quite as interesting to the nose as to the eye.

Some of the plants are more easily distinguished by their odor than by their appearance. For instance, dill (*Anethum graveolens*), fennel (*Foeniculum vulgare*), and caraway (*Carum Carvi*) are all short-stemmed herbs with feathery foliage and flowers similar to those of the wild carrot. Dill and fennel are particularly similar, it being no easy matter for the amateur to distinguish them by their appearance, but when one small leaf is crushed in the fingers all doubt vanishes. One has the spicy fragrance of caraway seeds, another the heavy sweet odor of anise, and the third smells like nothing but a dill pickle, for it is from the tiny fruits of the dill plant that this favorite condiment gets its distinctive flavor and odor.

Another interesting pair of closely related plants with differing smells is the tansy and yarrow, old-fashioned garden herbs with small daisy-like flowers. Each has a distinctive odor, hard to describe but never to be mistaken for anything else. Particularly interesting is a peculiar form of the tansy, the so-called "curled" tansy, with finely cut and curiously crimped foliage which somewhat resembles parsley.

Not all the fragrant members of the herb garden wear their perfume where it can be noticed by the passer-by. In some cases it is hidden within the stem, or packed away in the seeds. The old-fashioned garden flower, love-in-a-mist *(Nigella damascena)*, belongs to this latter class. Probably very few of those who have grown the plants have noticed the peculiar grape-like odor given off by the seeds when crushed. It is due to the same chemical which is now made synthetically and used in flavoring "grape" soft drinks and candies.

BRASSOCATTLEYA LOTOS

Brassocattleya Lotos, a hybrid between *Brassocattleya Digbyana-Mossiae* and *Cattleya Rex*, was originated in England in 1917 and a plant was purchased by the Garden in 1925. Upon its arrival in St. Louis it was transferred from a 4-inch pot to a 6-inch basket. The following season two young growths appeared which subsequently developed into two separate flowering shoots. The first sheath opened the second week in January, revealing three well-developed flowers with greenish sepals and yellowish petals flecked with bronze. The labellum is medium-sized with a fimbriated lip, light mauve with deep mauve stripes in the foreground.

NOTABLE ST. LOUIS GARDENS

II. The Garden of Mr. Albert G. Ulrich

Few of the people who pass down Arsenal Street every morning on their way to work realize that tucked away in a small back yard opposite Tower Grove Park is one of the most interesting gardens around Saint Louis. For sixteen years Mr. Ulrich has been struggling with a stubborn clay soil and constantly increasing city smoke, with the long droughts and the late spring freezes of our capricious climate. His present collection of roses and bulbous plants shows what can be done, in spite of these conditions, by an experienced gardener who is willing to give his plants constant care and attention.

The amount of material assembled and growing successfully on one city lot is perfectly amazing. There is a large

THE GARDEN OF MR. ALBERT G. ULRICH

HAEMANTHUS 'KING ALBERT'

collection of climbing and bush roses, a good-sized assortment of the better irises and peonies, a general sprinkling of perennials and annuals, and a collection of bulbous plants, including scillas, narcissi, lilies, and amaryllis, that in certain lines is not excelled by any botanical garden in this country.

Certain of Mr. Ulrich's recommendations as to plant material and cultural methods will be of interest to many city gardeners. The soil of his garden was originally a raw red clay. Two wagon-loads of sand were incorporated the first year, and the ground was then heavily manured. This manuring has been repeated every two or three years since. Commercial fertilizer is used on those plants which profit by it, and the iris collections have been given occasional top dressings of a little ground limestone.

Probably no one has had so extensive experience in growing roses in a city garden as has Mr. Ulrich. The best two climbers for our city conditions he finds to be "Aviateur Bleriot" and "Purity," and he recommends the latter as being similar to, and hardier than, the more popular "Silver Moon." In addition to these two he lists the following climbers as meritorious for this region:

American Pillar	Dr. Huey
Eugene Jacquet	Paul's Scarlet Climber
Coronation	Mary Wallace
Christine Wright	Dorothy Perkins
Hiawatha	Wichmoss

From his collection of hybrid teas and hybrid perpetuals the following are recommended:

HYBRID TEAS

Betty	Mme. Leon Pain
Radiance	Mme. Segond Weber
Lady Ursula	

HYBRID PERPETUALS

Frau Karl Druschki
Madame Charles Wood—good bloom in the fall
Magna Charta
Tom Wood

The hybrid perpetuals are given no protection. The hybrid teas have soil drawn up around them and are then covered

with leaves, across which are laid boards to hold the leaves and shed water during the winter.

In regard to perennials for the city garden, Mr. Ulrich has a few interesting suggestions. He finds that the garden heliotrope is thoroughly reliable under city conditions and is worthy of being more generally grown. He has also been very successful with hardy phlox but finds that they need to be well fertilized. He uses sheep manure in the spring, mixing it with wood ashes, and applies liquid manure when the plants are just coming into flower. Pyrethrums do better with him when raised from seed, as they are apparently better acclimatized and less liable to freeze during the winter. He plants them in April, transplanting them from the seed pan to small pots, then to larger pots, and keeping them in a cold-frame over the first winter, after which they are planted out in the garden. He grows delphiniums in the same way.

It is in his bulbous plants, however, particularly the amaryllis and its near relatives, that the glory of his collection lies. Zephyranthes, cooperias, pancratiums, and many another odd and unusual lily, are growing in his garden. The following list does not pretend to be complete but it will show the range of his taste and indicate some of the more interesting garden subjects:

Crinum—several species and hybrids
Amaryllis
Hymenocallis
Zephyranthes—windflower lily
Cooperia—rain lily
Haemanthus—blood lily
Hippeastrum
Pancratium illyricum—hardy in St. Louis
Lycoris squamigera—hardy, does not bloom the first year
Sprekelia formosissima—Mexican amaryllis
Lilium umbellatum—increases rapidly
Lilium longiflorum—does well between peonies
Montbretia—hardy, though not generally considered so
Muscari azureum—very early and good bloomer
Muscari moschatum—musk hyacinth
Scilla peruviana—does well with a little protection
Scilla taurica—fine
Scilla pratensis—a late bloomer, very beautiful
Scilla campanulata excelsior—very fine

Not satisfied with what the world already had to offer, Mr. Ulrich has made several new hybrids of his own, one of which, a hybrid blood lily (*Haemanthus* "King Albert") is shown in plate 27.

CHECK-LIST OF THE FERNS AND FLOWERING PLANTS INDIGENOUS TO THE MISSOURI BOTANICAL GARDEN EXTENSION, GRAY SUMMIT, MISSOURI

(Continued from the May Bulletin)

50. LINACEAE (Flax Family).
Linum sulcatum Riddell. Grooved yellow flax.
Linum virginianum L. Slender yellow flax.

51. OXALIDACEAE (Wood Sorrel Family).
Oxalis corniculata L. Lady's sorrel.
Oxalis violacea L. Violet wood sorrel.

52. GERANIACEAE (Geranium Family).
Geranium carolinianum L. Carolina cranesbill.
Geranium maculatum L. Wild cranesbill.

53. RUTACEAE (Rue Family).
Ptelea trifoliata L. Hop tree.
Zanthoxylum americanum Mill. Northern prickly ash.

54. SIMARUBACEAE (Quassia Family).
Ailanthus glandulosa Desf. Tree of heaven.

55. POLYGALACEAE (Milkwort Family).
Polygala verticillata L. Whorled milkwort.

56. EUPHORBIACEAE (Spurge Family).
Acalypha gracilens Gray. Three-seeded mercury.
Acalypha virginica L. Virginia three-seeded mercury.
Croton capitatus Michx. Hogwort.
Croton glandulosus L. Glandular croton.
Croton glandulosus var. *septentrionalis* Muell. Arg. Croton.
Croton monanthogynus Michx. Single-fruited croton.
Crotonopsis linearis Michx. Crotonopsis.
Euphorbia commutata Engelm. Tinted spurge.
Euphorbia corollata L. Flowering spurge.
Euphorbia dentata Michx. Toothed spurge.
Euphorbia heterophylla L. Painted leaf.
Euphorbia maculata L. Milk purslane.
Euphorbia obtusata Pursh. Blunt-leaved spurge.
Euphorbia Preslii Guss. Large-spotted spurge.
Phyllanthus caroliniensis Walt. Carolina phyllanthus.

57. CALLITRICHACEAE (Water Starwort Family).
Callitriche deflexa var. *Austini* (Engelm.) Hegelm. Water starwort.

58. ANACARDIACEAE (Cashew Family).
Rhus canadensis Marsh. Fragrant sumach.
Rhus copallina L. Dwarf sumach.
Rhus glabra L. Smooth sumach.
Rhus Toxicodendron L. Poison ivy.

59. AQUIFOLIACEAE (Holly Family).
Ilex decidua Walt. Winterberry.
Ilex verticillata (L.) A. Gray. Virginia winterberry.

60. CELASTRACEAE (Staff Tree Family).
Celastrus scandens L. Climbing bitter-sweet.
Evonymus atropurpureus Jacq. Burning bush, waahoo.

61. STAPHYLEACEAE (Bladder Nut Family).
Staphylea trifolia L. Bladder nut.

62. ACERACEAE (Maple Family).
Acer Negundo L. Box elder.
Acer rubrum var. *Drummondii* (H. & A.) T. & G. Drummond's maple.
Acer saccharum Marsh. Sugar maple.
Acer saccharum var. *nigrum* (Michx. f.) Britton. Black sugar maple.
Acer saccharinum L. White or silver maple.

63. SAPINDACEAE (Soapberry Family).
Aesculus glabra Willd. Ohio buckeye.

64. BALSAMINACEAE (Balsam Family).
Impatiens biflora Walt. Spotted touch-me-not.
Impatiens pallida Nutt. Pale touch-me-not.

65. RHAMNACEAE (Buckthorn Family).
Ceanothus americanus L. New Jersey tea.
Rhamnus caroliniana Walt. Carolina buckthorn.

66. VITACEAE (Grape Family).
Psedera quinquefolia (L.) Greene. Virginia creeper.
Vitis aestivalis Michx. Summer grape.
Vitis cinerea Engelm. Sweet winter grape.
Vitis cordifolia Michx. Frost grape.
Vitis vulpina L. River-bank grape.

67. TILIACEAE (Basswood Family).
Tilia americana L. Basswood, linden.

68. MALVACEAE (Mallow Family).
Abutilon Theophrasti Medic. Velvet leaf.
Malvastrum angustum Gray. Yellow false mallow.
Sida spinosa L. Prickly sida.

69. HYPERICACEAE (St. John's-wort Family).
Ascyrum hypericoides L. Saint Andrew's cross.
Hypericum mutilum L. Small-flowered St. John's-wort.
Hypericum perforatum L. Common St. John's-wort.
Hypericum cistifolium Lam. St. John's-wort.

70. CISTACEAE (Rockrose Family).
Lechea villosa L. Hairy pinweed.
Lechea minor L. Thyme-leaved pinweed.

71. VIOLACEAE (Violet Family).
Hybanthus concolor (Forster) Spreng. Green violet.
Viola cucullata Ait. Hooded blue violet.
Viola palmata L. Early blue violet.
Viola pedata L. Bird-foot violet.
Viola pedata var. *bicolor* Pursh. Two-colored bird-foot violet.
Viola pubescens Ait. Downy yellow violet.
Viola striata Ait. Striped violet.

72. PASSIFLORACEAE (Passion Flower Family).
Passiflora lutea L. Yellow passion flower.

73. CACTACEAE (Cactus Family).
Opuntia Rafinesquii Engelm. Prickly-pear cactus.

74. LYTHRACEAE (Loosestrife Family).
Cuphea petiolata (L.) Koehne. Clammy cuphea.

75. ONAGRACEAE (Evening Primrose Family).
Circaea Lutetiana L. Enchanter's nightshade.
Gaura biennis L. Biennial gaura.
Ludvigia palustris (L.) Ell. Water purslane.
Oenothera biennis L. Common evening primrose.
Oenothera missouriensis Sims. Missouri primrose.
Oenothera serrulata Nutt. Tooth-leaved evening primrose.

76. UMBELLIFERAE (Parsley Family).
Chaerophyllum procumbens (L.) Crantz. Spreading chervil.
Cryptotaenia canadensis (L.) DC. Honewort.
Daucus Carota L. Wild carrot, Queen Anne's lace.
Erigenia bulbosa (Michx.) Nutt. Harbinger-of-spring.
Osmorhiza Claytoni Michx. Wooly sweet cicely.
Osmorhiza longistylis (Torr.) DC. Smoother sweet cicely.
Polytaenia Nuttallii DC. Polytaenia.
Sanicula marilandica L. Black snake-root.
Taenidia integerrima (L.) Drude. Yellow pimpernel.
Thaspium barbinode (Michx.) Nutt. Hairy-jointed meadow parsnip.
Thaspium trifoliatum (L.) Britton. Purple meadow parsnip.
Torilis Anthriscus (L.) Bernh. Erect hedge parsnip.
Zizia aurea (L.) Koch. Golden Alexanders.

77. CORNACEAE (Dogwood Family).
Cornus asperifolia Michx. Rough-leaved cornel.
Cornus florida L. Flowering dogwood.
Cornus stricta Lam. Stiff cornel.

78. PRIMULACEAE (Primrose Family).
Androsace occidentalis Pursh. Androsace.
Dodecatheon Meadia L. Shooting star.
Samolus Valerandi L. Water pimpernel.

Steironema lanceolatum (Walt.) A. Gray. Lance-leaved loosestrife.

79. SAPOTACEAE (Sapodilla Family).
Bumelia lanuginosa (Michx.) Pers. False buckthorn.

80. EBENACEAE (Ebony Family).
Diospyros virginiana L. Persimmon.

81. OLEACEAE (Olive Family).
Adelia acuminata Michx. Swamp privet.
Fraxinus americana L. White ash.
Fraxinus pennsylvanica var. *lanceolata* (Borkh.) Sarg. Green ash.
Fraxinus quadrangulata Michx. Blue ash.

82. GENTIANACEAE (Gentian Family).
Sabatia angularis (L.) Pursh. Rose pink.

83. APOCYNACEAE (Dogbane Family).
Amsonia Tabernaemontana Walt. Amsonia.
Apocynum canabinum L. Indian hemp.

84. ASCLEPIADACEAE (Milkweed Family).
Acerates lanuginosa (Nutt.) Dcne. Hairy milkweed.
Acerates floridana (Lam.) Hitchc. Green milkweed.
Asclepias incarnata L. Swamp milkweed.
Asclepias purpurascens L. Purple milkweed.
Asclepias quadrifolia Jacq. Four-leaved milkweed.
Asclepias syriaca L. Silkweed.
Asclepias tuberosa L. Butterfly-weed, pleurisy root.
Asclepias verticillata L. Whorled milkweed.
Asclepiodora viridis (Walt.) Gray. Oblong-leaved milkweed.
Gonolobus laevis Michx. Angle-pod.
Vincetoxicum carolinense (Jacq.) Britton. Vincetoxicum.

85. CONVOLVULACEAE (Morning-glory Family).
Convolvulus arvensis L. Field bindweed.
Convolvulus sepium L. Hedge bindweed.
Cuscuta Gronovii Willd. Gronovius' dodder.
Ipomoea hederacea Jacq. Ivy-leaved morning-glory.
Ipomoea pandurata (L.) G. W. F. Meyer. Wild potato-vine.

86. POLEMONIACEAE (Polemonium Family).
Phlox divaricata L. Wild Sweet-William.
Phlox pilosa L. Downy phlox.
Polemonium reptans L. Greek valerian.

87. HYDROPHYLLACEAE (Waterleaf Family).
Ellisia Nyctelea L. Nyctelea.
Hydrophyllum appendiculatum Michx. Appendaged waterleaf.
Hydrophyllum canadense L. Broad-leaved waterleaf.
Hydrophyllum virginianum L. Virginia waterleaf.
Phacelia Purshii Buckley. Pursh's phacelia.

88. BORAGINACEAE (Borage Family).
Cynoglossum boreale Fernald. Stickseed.

Heliotropium tenellum (Nutt.) Torr. Slender heliotrope.
Lappula virginiana (L.) Greene. Beggar's lice.
Lithospermum arvense L. Corn gromwell.
Lithospermum canescens (Michx.) Lehm. Puccoon.
Onosmodium hispidissimum Mackenzie. Shaggy false gromwell.

89. VERBENACEAE (Vervain Family).
Lippia lanceolata Michx. Fog-fruit.
Verbena angustifolia Michx. Narrow-leafed vervain.
Verbena canadensis (L.) Britton. Large-flowered verbena.
Verbena stricta Vent. Hoary vervain.
Verbena urticaefolia L. Nettle-leaved vervain.

90. LABIATAE (Mint Family).
Agastache nepetoides (L.) Ktze. Giant hyssop.
Blephilia ciliata (L.) Raf. Downy blephilia.
Blephilia hirsuta (Pursh) Benth. Hairy blephilia.
Cunila origanoides (L.) Britton. Common dittany.
Hedeoma hispida Pursh. Rough pennyroyal.
Hedeoma pulegioides (L.) Pers. American pennyroyal.
Marrubium vulgare L. Horehound.
Monarda Bradburiana Beck. Bradbury's monarda.
Monarda fistulosa L. Wild bergamot.
Perilla frutescens (L.) Britton. Perilla.
Physostegia virginiana (L.) Benth. False dragon head.
Prunella vulgaris L. Heal-all.
Pycnanthemum flexuosum (Walt.) BSP. Narrow-leaved mountain mint.
Pycnanthemum pilosum Nutt. Hairy mountain mint.
Salvia lyrata L. Lyre-leaved sage.
Scutellaria canescens Nutt. Downy skullcap.
Scutellaria parvula Michx. Small skullcap.
Scutellaria versicolor Nutt. Heart-leaved skullcap.
Stachys palustris L. Woundwort.
Teucrium canadense L. American germander.
Trichostema dichotomum L. Bastard pennyroyal.

91. SOLANACEAE (Nightshade Family).
Datura Stramonium L. Jimson weed.
Datura Tatula L. Purple thorn apple.
Physalis angulata L. Cut-leaved ground cherry.
Physalis pubescens L. Low hairy ground cherry.
Physalis subglabrata Mackenzie & Bush. Ground cherry.
Solanum carolinense L. Horse nettle.
Solanum nigrum L. Common nightshade.

92. SCROPHULARIACEAE (Figwort Family).
Bacopa rotundifolia (Michx.) Wettst. Round-leaved hyssop.
Conobea multifida (Michx.) Benth. Conobea.
Gerardia Skinneriana Wood. Skinner's gerardia.
Gerardia tenuifolia Vahl. Slender gerardia.
Ilysanthes dubia (L.) Barnhart. False pimpernel.

Linaria canadensis (L.) Dumont. Blue toadflax.
Mimulus alatus Ait. Sharp-winged monkey-flower.
Pedicularis canadensis L. Common lousewort.
Pentstemon hirsutus (L.) Willd. Hairy beard-tongue.
Pentstemon laevigatus Ait. Smooth beard-tongue.
Pentstemon laevigatus var. *Digitalis* (Sweet) Gray. Fox-glove, beard-tongue.
Scrophularia marilandica L. Maryland figwort.
Seymeria macrophylla Nutt. Mullein, foxglove.
Verbascum Blattaria L. Mullein.
Verbascum Thapsus L. Common mullein.
Veronica arvensis L. Wall speedwell.
Veronica peregrina L. Purslane, speedwell.
Veronica virginica L. Culver's root.

93. BIGNONIACEAE (Bignonia Family).
Tecoma radicans (L.) Juss. Trumpet creeper.

94. PHRYMACEAE (Lopseed Family).
Phryma Leptostachya L. Lopseed.

95. ACANTHACEAE (Acanthus Family).
Dianthera americana L. Water willow.
Ruellia ciliosa Pursh. Hairy ruellia.
Ruellia strepens L. Smooth ruellia.

96. PLANTAGINACEAE (Plantain Family).
Plantago aristata Michx. Large-bracted plantain.
Plantago elongata Pursh. Slender plantain.
Plantago lanceolata L. Ribgrass.
Plantago Rugelii Dcne. Rugel's plantain.
Plantago virginica L. Dwarf plantain.

97. RUBIACEAE (Madder Family).
Cephalanthus occidentalis L. Buttonbush.
Diodia teres Walt. Buttonweed.
Galium asprellum Michx. Rough bedstraw.
Galium circaezans Michx. Wild liquorice.
Galium concinnum T. & G. Shining bedstraw.
Galium pilosum Ait. Hairy bedstraw.
Galium virgatum Nutt. Southwestern bedstraw.
Houstonia angustifolia Michx. Narrow-leaved houstonia.
Houstonia minima Beck. Bluet.
Houstonia purpurea L. Large houstonia.

98. CAPRIFOLIACEAE (Honeysuckle Family).
Sambucus canadensis L. Common elder.
Symphoricarpos orbiculatus Moench. Indian currant.
Triosteum angustifolium L. Yellow horse-gentian.
Triosteum perfoliatum L. Tinker's weed.
Viburnum Lentago L. Sheepberry.
Viburnum prunifolium L. Black haw.
Viburnum rufidulum Raf. Southern black haw.

99. VALERIANACEAE (Valerian Family).
Valerianella radiata (L.) Dufr. Beaked corn salad.

100. CUCURBITACEAE (Gourd Family).
Sicyos angulatus L. One-seeded bur cucumber.

101. CAMPANULACEAE (Bellflower Family).
Campanula americana L. Tall bellflower.
Specularia perfoliata (L.) A. DC. Venus's looking-glass.

102. LOBELIACEAE (Lobelia Family).
Lobelia inflata L. Indian tobacco.
Lobelia leptostachys A. DC. Spiked lobelia.
Lobelia siphilitica L. Great blue lobelia.

103. COMPOSITAE (Composite Family).
Achillea Millefolium L. Common yarrow.
Actinimeris alternifolia (L.) DC. Actinomeris.
Ambrosia artemisiifolia L. Hog-weed.
Ambrosia trifida L. Great ragweed.
Antennaria plantaginifolia (L.) Richards. Plantain-leaved everlasting.
Anthemis Cotula L. May-weed, dog fennel.
Arctium minus Bernh. Common burdock.
Aster anomalus Engelm. Many-rayed aster.
Aster azureus Lindl. Sky-blue aster.
Aster cordifolius L. Blue wood aster.
Aster Drummondii Lindl. Drummond's aster.
Aster ericoides L. White heath aster.
Aster laevis L. Smooth aster.
Aster lateriflorus (L.) Britton. Aster.
Aster multiflorus Ait. Dense-flowered aster.
Aster oblongifolius Nutt. Aromatic aster.
Aster paniculatus Lam. Tall white aster.
Aster patens Ait. Late purple aster.
Aster sagittifolius Wedemeyer. Arrow-leaved aster.
Aster salicifolius Ait. Willow aster.
Aster turbinellus Lindl. Prairie aster.
Bidens aristosa (Michx.) Britton. Western tickseed sunflower.
Bidens bipinnata L. Spanish needles.
Bidens connata Muhl. Swamp beggar-ticks.
Bidens laevis (L.) BSP. Smooth bur-marigold.
Brauneria angustifolia (DC.) Heller. Narrow-leaved purple cone-flower.
Cacalia atriplicifolia L. Pale Indian plantain.
Cacalia reniformis Muhl. Great Indian plantain.
Cacalia tuberosa Nutt. Tuberous Indian plantain.
Chrysanthemum Leucanthemum L. Ox-eye daisy.
Cichorium Intybus L. Chicory.
Cirsium altissimum (L.) Spreng Roadside thistle.
Cirsium lanceolatum (L.) Hill. Bull thistle.
Cirsium pumilum (Nutt.) Spreng. Pasture thistle.

Coreopsis lanceolata var. *villosa* Michx. Hairy tickseed.
Coreopsis palmata Nutt. Tickseed.
Coreopsis pubescens Ell. Star tickseed.
Dyssodia papposa (Vent.) Hitchc. Fetid marigold.
Eclipta alba (L.) Hassk. Eclipta.
Elephantopus carolinianus Willd. Elephant's foot.
Erechtites hieracifolia (L.) Raf. Fireweed.
Erigeron annuus (L.) Pers. Daisy fleabane.
Erigeron canadensis L. Horseweed.
Erigeron divaricatus Michx. Purple horseweed.
Erigeron philadelphicus L. Philadelphia fleabane.
Erigeron pulchellus Michx. Robin's plantain.
Erigeron ramosus (Walt.) BSP. Daisy fleabane.
Eupatorium coelestinum L. Mist-flower.
Eupatorium perfoliatum L. Boneset.
Eupatorium purpureum L. Joe-Pye weed.
Eupatorium serotinum Michx. Late-flowering thoroughwort.
Eupatorium urticaefolium Reichard. White snakeroot.
Gnaphalium polycephalum Michx. Common everlasting.
Helenium autumnale L. False sunflower.
Helenium nudiflorum Nutt. Purple-head sneezeweed.
Helianthus annuus L. Common sunflower.
Helianthus hirsutus Raf. Stiff-haired sunflower.
Helianthus laetiflorus Pers. Showy sunflower.
Helianthus tuberosus L. Jerusalem artichoke.
Heliopsis helianthoides (L.) Sweet. False sunflower.
Hieracium Gronovii L. Gronovius' hawkweed.
Iva ciliata Willd. Rough marsh elder.
Krigia amplexicaulis Nutt. Virginia goat's-beard.
Kuhnia eupatorioides L. False boneset.
Lactuca canadensis L. Wild lettuce.
Lactuca floridana L. Florida lettuce.
Lactuca integrifolia Bigel. Arrow-leaved lettuce.
Lactuca ludoviciana (Nutt.) Riddell. Western lettuce.
Lactuca scariola L. Prickly lettuce.
Lepachys pinnata (Vent.) T. & G. Gray-headed cone-flower.
Liatris scariosa Willd. Scaly blazing-star.
Parthenium integrifolium L. American fever-few.
Parthenium repens Eggert. Creeping fever-few.
Polymnia canadensis L. Small-flowered leaf-cup.
Prenanthes alba L. White lettuce.
Prenanthes aspera Michx. Rough white lettuce.
Rudbeckia fulgida Ait. Orange cone-flower.
Rudbeckia hirta L. Black-eyed Susan.
Rudbeckia laciniata L. Tall cone-flower.
Rudbeckia triloba L. Thin-leaved cone-flower.
Senecio aureus L. Golden ragwort.
Senecio obovatus Muhl. Round-leaf squaw-weed.
Senecio plattensis Nutt. Prairie ragwort.

Silphium integrifolium Michx. Entire-leaved rosin-weed.
Silphium laciniatum L. Compass plant.
Silphium perfoliatum L. Cup plant.
Silphium terebinthinaceum Jacq. Prairie dock.
Solidago canadensis L. Canada golden-rod.
Solidago Drummondii T. & G. Drummond's golden-rod.
Solidago latifolia L. Broad-leaved golden-rod.
Solidago nemoralis Ait. Field golden-rod.
Solidago petiolaris Ait. Downy ragged golden-rod.
Solidago radula Nutt. Western rough golden-rod.
Solidago rigida L. Stiff golden-rod.
Solidago serotina Ait. Late golden-rod.
Solidago ulmifolia Muhl. Elm-leaved golden-rod.
Sonchus asper (L.) Hill. Spiny-leaved sow-thistle.
Sonchus oleraceus L. Annual sow-thistle.
Tanacetum vulgare L. Common tansy.
Taraxacum officinale Weber. Dandelion.
Verbesina helianthoides Michx. Sunflower crownbeard.
Vernonia Baldwini Torr. Baldwin's ironweed.
Vernonia crinita Raf. Great ironweed.
Vernonia fasciculata Michx. Western ironweed.
Xanthium canadense Mill. American cocklebur.

NOTES

The St. Louis Florist Club held its forty-second anniversary meeting at the Gray Summit Extension, June 14.

The members of the St. Louis Association of Gardeners were guests of the Garden, at the Gray Summit Extension, June 3. Mr. L. P. Jensen, Arboriculturist to the Garden, gave a talk on "The Missouri Botanical Garden Extension."

The American Federation of Organizations for the Hard of Hearing, meeting in St. Louis, June 18-22, visited the Garden, June 21.

A party of Washington University summer-school students, in charge of Prof. D. W. Stipton, professor of geology, visited the Garden, June 23, and were conducted through the buildings and grounds by Mr. G. H. Pring, Superintendent of the Garden.

At the commencement of Washington University, June 5, the degree of doctor of philosophy was conferred on Ethel Taber Eltinge, Jessie R. Barr Research Fellow at the Garden, and that of master of science on Edward L. Evinger, Rufus J. Lackland Research Fellow at the Garden.

Recent visitors to the Garden include Dr. Christobal M. Hicken, professor of botany, University of Buenos Aires, Argentina, on May 21; and Prof. Takashi Naito, assistant professor of botany and phytopathology, Imperial College of Agriculture and Forestry, Kagoshima, Japan, on June 16.

The second number of Volume XV of the ANNALS OF THE MISSOURI BOTANICAL GARDEN has been issued with the following contents:

"Sources of Energy for Azotobacter, with Special Reference to Fatty Acids," P. L. Gainey.

"The Effect of Ultra-Violet Radiation Upon Higher Plants," Ethel T. Eltinge.

STATISTICAL INFORMATION FOR MAY, 1928

GARDEN ATTENDANCE:

Total number of visitors.....35,101

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 21
Total number of books and pamphlets donated..... 107

HERBARIUM ACCESSIONS:

By Purchase—
Broadway, W. E.—Plants of Trinidad and Tobago..... 100
Thompson, J. W.—Plants of Oregon..... 525

By Gift—
Anderson, Dr. Edgar—*Iris caroliniana* Watson from North Carolina 1
Dodge, Dr. C. W.—Plant of Massachusetts..... 1
Elend, Mr. W. C.—*Platanus occidentalis* L. from Missouri. 1
Evinger, E. L.—Plants of Missouri..... 6
Featherly, H. J.—*Notholaena sinuata* (Sw.) Kaulf. from Oklahoma 1
Holmes, Mr. C. W.—Photograph of *Agave* sp. from Oaxaca, Mexico 1
Kellogg, John H.—Plants from Iron Mountain, Mo..... 2
Ledman, O.—*Myosuris minimus* L. from Missouri..... 1
Linder, Dr. D. H.—Fungi of Missouri..... 10
Mathias, Miss Mildred E.—Plants of Sulphur Springs, Mo. 17

By Exchange—
Merrill, Professor E. D.—Plants of China..... 190
U. S. Department of Agriculture, by A. S. Hitchcock—
Grasses of Bolivia..... 91

By Field Work—
Greenman, J. M.—Plants of Missouri..... 28

Total 975

SOME FACTS ABOUT THE GARDEN

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Painter

W. F. LANGAN,
Chief Engineer

H. VALLENTINE,
Carpenter

GRAY SUMMIT EXTENSION

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Arboriculturist

D. MILLER,
Orchids

G. GOEDEKE,
Farm

R. E. KISSECK,
Engineer

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Manager

Missouri Botanical Garden Bulletin

Vol. XVI SEPTEMBER, 1928 No. 7

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FLOWERS OF SABATIA ANGULARIS

SABATIA ANGULARIS IN ITS NATIVE HABITAT

Missouri Botanical Garden Bulletin

Vol. XVI SEPTEMBER, 1928 No. 7

A NOTABLE NATIVE PLANT

Few of our native wild flowers are as lovely as the sabatias or rose pinks. Two species are found in Missouri; one (*Sabatia campestris* Nutt.) on our southwestern prairies, and another (*Sabatia angularis* (L.) Pursh) in old fields or open woods throughout most of the state. Unlike the prairie-loving species, *Sabatia angularis* does not ordinarily grow in large masses, but is usually found in scattered groups among other plants. However, there sometimes comes a year when conditions are favorable for the growth of the young plants and then it appears in conspicuous numbers, and many people see it for the first time. The year 1928 has been one of these unusual years, and there have been numerous inquiries at the Garden as to the name of the pretty little plant with the white or pink flowers.

Rose pink is indeed scarcely a fitting name for *Sabatia angularis* as it is found around St. Louis, for with us the flowers are quite as often white as they are pink. At the Garden Extension at Gray Summit only about two dozen pink-flowering plants were found among several hundred white ones. In the eastern states, however, the proportions are reversed, and it is the white flowers which are in the minority. The low-growing prairie species of western Missouri, *Sabatia campestris* Nutt., is much more constant, for it has never been reported as bearing white flowers.

The rose pink usually behaves as an annual, coming up anew each year from seeds scattered the previous fall. By

the middle of the summer the young seedlings have reached a height of one to two feet and above their delicate leaves their showy flowers are borne, about an inch across, in conspicuous pyramidial cymes (pl. 28).

While the plant is seldom seen in cultivation in this country it has long been known in Europe, and William Robinson, in his "English Flower Garden", London, 1903, gives the following directions for its culture: "Sabatia angularis, American Centaury, should be given a sheltered situation and partial shade, in imitation of that afforded by the vegetation amongst which it grows wild. The soil should consist of equal parts of good fibry loam and finely-sifted leaf-mold, with enough sand to make it open. The seed should be sown in summer. The seedlings should be potted off before they become in the least drawn, or they will make weak plants, and they should be wintered in a cold, airy frame. In spring repeatedly stopping the shoots will induce them to form bushy plants before flowering." By writing that the seeds should be sown in summer, he evidently means that they should be sown immediately after ripening.

SUMAC LEMONADE

From the time its berries ripen in midsummer until well into the winter, no bush is more conspicuous along the roadsides of eastern North America than the common sumac (pl. 29). It is so attractive in fruit, particularly when the leaves also turn red after frost, that gardeners have forgiven it for being commonplace and native and of late years have taken it into their gardens. A very few of the thousands who have seen and admired the brilliant fruits may have tasted them and found that they were distinctly acid, rather like lemon juice with a hint of strawberry or cherry flavoring. Fewer still have learned that they are indeed so lemon-like that we can use them, as did the American Indians, to produce a very refreshing fruit drink which can scarcely be distinguished from genuine lemonade.

Any of our common red-berried summer-fruiting sumacs

may be used: the common stag-horn sumac (*Rhus typhina*), its milky-juiced relative, the smooth sumac (*Rhus glabra*), or the much smaller dwarf sumac (*Rhus copallina*). The ade can be made any time after the fruits have ripened until the berries have fallen. The ripeness of the fruits can be tested in several ways, most easily by the smell. When fully ripe they smell surprisingly like red-raspberry jam. It may be that the dark red color adds to the illusion, but no other two materials have ever seemed so strikingly similar in odor as sumac berries warmed by the sun of an August afternoon and freshly made strawberry jam. A more exact method of testing the fruits is by the taste. The fruits are ripe if the finger, when rubbed gently over them, tastes sharply acid, much as though it had been stuck in a cut lemon. The flavor in which we are interested is located in the hairs which clothe the fruit, the juice itself being bitter. For this reason one needs to get as much flavor as possible out of the hairs and as little as possible from the rest of the plant.

Little equipment is needed to make the drink: one or two basins or large bowls, a fine-meshed cheese-cloth, and a pitcher of water. Fill one of the bowls partly full of water, take up a single head of sumac and break or brush off the separate berries, working as rapidly as possible. Repeat the process with two or three more heads until the water is fairly full of berries. Then plunge the tips of the fingers into the water and rub the berries briskly between them. Do not squeeze too hard, for the object is not to press out the juice, but to break the tiny hairs on the surface. Rub for a few minutes, then strain the liquid through a double-folded cheese-cloth, sweeten, and dilute to taste.

If the directions have been followed the flavor may be depended upon. It varies somewhat with the three species used but may generally be compared to lemonade with a dash of cherry juice. The color is quite another matter. It is never twice the same and can be anything from a dirty yellow or ruddy brown to a bright rose or orange. Freshly ripened fruit usually gives brighter colors than that collected during the winter, but even here there are too many exceptions to permit a rule.

"But what about poison sumac," some one will say, "is there no danger of getting hold of it by mistake?" None at all, as long as only red-fruited sumacs are gathered. So much has been written and told about "poison shumacks" and so few people have seen the real article, that in many parts of the country it is commonly believed that red sumacs are the poisonous ones. Fortunately, the true poison sumacs are strikingly different from the red-berried ones. They are swamp-loving shrubs and are seldom met with by those who have a fear of wet feet. Furthermore, their berries are a dirty white and hang down in open clusters. For them, as for many other poison berries, the rhyme we learned in childhood is a safe guide:

"Berries red, have no dread.
Berries white, flee from sight."

A RARE PANAMANIAN ORCHID

Among the rare Central-American orchids collected in the Chiriqui region of Panama in 1927 was *Acineta chrysantha*, the curious species illustrated in plate 30. When originally discovered it was by no means so attractive, for the plant was not then in flower. It was found growing intermixed with several other interesting orchids, mainly Epidendrums, on an old fern-covered tree trunk in the coffee finca (plantation) of Mr. A. Guterriez of Palo Alto. The tree trunk was about fifteen feet high, and the plants of Acineta were growing at the top, fully exposed to the sun except for such slight shade as might be yielded by the sword ferns (Nephrolepis) which crowded about it. At first glance the plant might have been taken for a species of Lycaste which it resembled on account of its large pseudo-bulbs. However, Lycaste is not found in such exposed situations and prefers moist shady spots along river banks. Other characteristics which serve to distinguish it definitely are the leathery, upright leaves, and the corrugated pseudo-bulbs.

The collected plant was brought to the Garden and given the same treatment as a Stanhopea, or bucket orchid, which

SUMAC FOLIAGE.

SUMAC IN FRUIT.

ACINETA CHRYSANTHA.

it resembles in many ways. Like the bucket orchid, its pendulous flower spikes are sent out through the base of the basket in which it is grown. The flower, as can be seen in plate 30, is exceedingly complex in structure. The quaintly shaped flowers are borne on a gracefully drooping spike. The sepals are slightly incurved and are about one and a half inch long and one inch wide. The species might well be called "umbrella orchid," for its dorsal sepal is hood-shaped and protects the column from the rain, which in its native home is a daily occurrence, due to the trade winds from the Atlantic coming in contact with the Continental Divide. The petals are narrower than the sepals, somewhat obovate, spotted with purplish brown, fading toward the acute tips. The lip is a golden yellow spotted with purplish brown, and is divided into three parts, with wings at the side. The entire lip is boat-shaped or scoop-shaped, with a tongue-like disc within. The caudicle supports two large pollen masses and at its base is a prominent bifid disc.

THE FLOWER SHOWS IN THE FLORAL DISPLAY HOUSE DURING 1928-1929

The flower-loving public considers the chrysanthemum show the most important event in the floral year, and more people are annually drawn to it than to any other display at the Garden. Indeed, the great range in color of the chrysanthemum and the bold masses in which it can be displayed make this a most brilliant show. For many years the Garden has staged chrysanthemum shows, at first in a tent in the sunken garden where the lily pools now are, later in the two wings of the present palm-house range, and since its erection in 1915, in the floral display house every November.

This year the St. Louis florists will hold their first fall flower show in the Garden greenhouse on November 8, 9, 10, and 11. As the florists will use every available space the Garden will keep its chrysanthemums in the growing houses until after their show. However, if a sufficient number of chrysanthemums are in bloom in the last week of October a

preliminary show will then be staged which will continue until Sunday, November 4. The following day the plants will be removed and the display house given over to the florists for the erection of their booths. The St. Louis Fall Flower Show, sponsored by the florists, will open on Thursday afternoon, November 8, and will continue until Sunday, November 11. On these four days the display room will remain open until ten o'clock at night. While the chrysanthemum will be the dominating flower at that show, other flowers including roses and carnations will be exhibited. There will be booths, table decorations, corsage and bridal bouquets, ferneries, baskets of flowers, and foliage plants. On November 12 the florists will dismantle their show, and as soon as the greenhouse can be cleared the final and complete display of chrysanthemums will be installed. This show will be unique this year in that it will have a Japanese setting. The ever-popular baskets of chrysanthemums which are suspended from the roof of the house will be a feature of the display.

The first week in December the chrysanthemums will be replaced by the poinsettia. This popular Christmas flower will be on view until the end of the month. Stevia, Cleveland cherries, and other flowers will be used to give the poinsettia a proper setting.

In early January the primroses will be shown. Later in the month the fairy primrose will serve as a background for the orchids which as they bloom will be sent from the Garden Extension to the floral display house. In February the orchids will be in their prime and will be shown in great variety. While only a few years ago the orchid was a rare and little-known flower, it now has many admirers. Since the first display several years ago the number of people viewing this show has steadily increased each year until now the attendance rivals that of the chrysanthemum show. The orchid show will continue during the month of February. In the last half of this month the brilliant cinerarias will also be exhibited in a section of the display room.

In early March the bulb show will be installed. The hyacinths displayed last year in a Dutch garden attracted many visitors, and this year an equally attractive planting of bulbs

in a different setting will be staged. With favorable weather conditions the bulb show should last at least two weeks. The St. Louis florists will in all probability again hold a spring flower show in late March, as they have in the past two years.

Following the florists' show, should there be one, there will be staged in April a collection of hybrid schizanthus, commonly called the butterfly-flower, together with a variety of spring-blooming plants, including snapdragons, marguerites, begonias, calendulas, lupines, etc. Beautiful hybrid pelargoniums will also be shown.

In May the beautiful salpiglossis, which created so much comment and admiration last spring, will be displayed in great variety, as well as other spring-blooming annuals.

During June, July, and August there will be a succession of annuals and a collection of begonias, caladiums, ferns and palms.

In September the china asters will grace the floral display house, and these will be followed by the dahlias in October.

NOTES

About 200 members attending the convention of International Stereotypers and Electrotypers of North America visited the Garden during July.

Mr. George H. Pring, Superintendent of the Garden, addressed the Alton Kiwanis Club, July 10, on "Orchid Exploration in Central America."

The May and July issues of "Garden Life" contain an article by Mr. L. P. Jensen, Aboriculturist to the Garden, on "Wild Flowers for the Garden."

Dr. George T. Moore, Director of the Garden, spoke before the Executives Club of St. Louis, September 7, on "The Work of the Missouri Botanical Garden."

Mr. L. P. Jensen, Aboriculturist to the Garden, gave a talk on "Wild Flowers" before the members of the Osage Hills Garden Club when they were guests of the Garden at the Gray Summit Extension, August 3.

The members of the St. Louis Association of Cemetery Officials were guests of the Garden at the Gray Summit Extension, July 11, and during the course of their visit Mr. L. P. Jensen, Arboriculturist to the Garden, gave them an informal talk on "The Missouri Botanical Garden Extension."

The students in botany at the Western State Normal School, Kalamazoo, Michigan, in charge of Dr. L. A. Kenoyer, professor of biology at that institution, visited the Garden, July 30, and were conducted on a tour of the grounds, herbarium and library by Mr. Paul A. Kohl, Floriculturist to the Garden, and Dr. J. M. Greenman, Curator of Herbarium.

Visitors to the Garden during the summer months include the following: Mr. W. W. Ashe, assistant district forester, U. S. Forest Service; Prof. Frederick Dunlap, extension forester, Missouri Agricultural Extension Service; Dr. K. Shen, professor of German, Nanyange University, Shanghai, China; Mr. Aaron J. Sharp, instructor in botany, University of Oklahoma; Mr. P. C. Standley, acting curator, Field Museum of Natural History, Chicago; Dr. E. E. Sherff, instructor in botany, Chicago Normal College; Prof. Robert Stratton, assistant professor of botany, Oklahoma Agricultural and Mechanical College, Stillwater; Prof. H. I. Featherly, assistant professor of botany and plant pathology, Oklahoma Agricultural and Mechanical College, Stillwater; Count Adam Zamoyski, International President of the Polish Falcons of the World, and his daughter-in-law, Countess Jadwiga Zamoyski, physical director of that organization; Mr. F. A. Riedel, of Kansas State Teachers' College, Pittsburg, Kansas; Dr. Y. Tochinai, assistant professor of phytopathology, Hokkaido Imperial University, Sapporo, Japan; Prof. and Mrs. Morton E. Peck, of Willamette University, Salem, Oregon; Dr. Charles Piper Smith, teacher of economic biology, San Jose, California; Mr. E. W. Graves, of Beutonsport, Iowa; Mr. Arno H. Nehrling, of Richmond, Indiana; Mr. Jason R. Swallen, junior botanist, Smithsonian Institution, Washington, D. C.

STATISTICAL INFORMATION FOR JUNE-AUGUST, 1928

GARDEN ATTENDANCE:

Total number of visitors in June 46,292
Total number of visitors in July 30,426
Total number of visitors in August 42,295

PLANT ACCESSIONS:

Total number of plants and seed packets received as gifts
in June 103
in July 19
in August 19

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought in June... 21
Total number of books and pamphlets donated in June.. 224
Total number of books bought in July..... 71
Total number of books and pamphlets donated in July.. 203
Total number of books and pamphlets bought in August 24
Total number of books and pamphlets donated in August 255

HERBARIUM ACCESSIONS:

JUNE

By Purchase—
Maxon, Dr. William R.—Plants of Haiti collected by W. J. Eyerdam..... 89

By Gift—
Bettis, Mrs. James R.—Plants of Missouri..... 3
Child, Miss Marion—Plants of New Mexico..... 68
Featherly, H. I.—Plants of Oklahoma..... 3
Harrell, Mrs. J. A. J.—Plant from horticulture..... 1
Kelso, Leon—*Mentzelia* from Colorado..... 6
Klaus, H. H.—*Quercus macrocarpa* Michx. from Missouri.. 1
Mensing, Mrs. Fred—*Cypripedium parviflorum* Salib. var. *pubescens* (Willd.) Knight, from Missouri..... 1
Palmer, E. J.—Cacti of Western Texas..... 10
Pring, George H.—*Nepenthes* of horticulture..... 6
Woodson, Robert E., Jr.—Fragments of type of *Apocynum grandiflorum* Dang. 1

By Exchange—
Gray Herbarium of Harvard University—Plants of Margarita Island, Venezuela..... 137

Total 326

JULY

By Purchase—
Bush, B. F.—Plants of Missouri..... 255
Metcalf, Franklin P.—Plants of China..... 285
Pittier, Dr. H.—Plants of Venezuela..... 320
Seymour, Frank C.—Plants of the Mexican Gulf Coast, Set. 2, Fascicle 2, Nos. 101-200, inclusive..... 100

By Gift—
Bradley, Mrs. Catherine E.—*Oenothera biennis* L. of Missouri 1
Davis, Miss Ella B.—*Smilax rotundifolia* L. from Illinois.. 1
Evans, Miss Lucile—*Syringa chinensis* Vahl from horticulture 1
Henderson, Prof. L. F.—*Senecio Harfordii* Greenman, from Oregon 1
Hlasten, Mrs. F. M.—Plants of Illinois..... 2
Jennison, Prof. H. M.—Plants of Tennessee..... 2
Kellogg, John H.—*Dianthus Armeria* L. from Missouri... 1
Larsen, Miss Esther L.—Moss from St. Louis County, Mo. 1
La Garde, Dr. Roland—Fungus from Missouri..... 1
Linder, Dr. David H.—Fungi from Massachusetts..... 9
Martin, G. W.—Fungus from Iowa..... 1
Mason, Miss Edith—Plants of New Hampshire..... 5
Pring, George H.—*Odontoglossum Powellii* from Panama.. 2
By Exchange—
Drushel, Prof. J. A.—Plants of eastern United States..... 200

Total 1,188

AUGUST

By Purchase—
Merrill, Prof. E. D.—Plants of Indo-China collected by Mrs. M. S. Clemens..... 673
Metcalf, Franklin P.—Plants of the Province of Fukien, China 480
Petrak, Dr. F.—"Mycotheca generalis," Century I, Nos. 1-100, inclusive 100
By Gift—
Daniel, F. M.—*Smilacina racemosa* (L.) Desf. from Arkansas 1
Dougan, Lewis M.—*Hoya carnosa* R. Br., from horticulture 1
Johnson, Dr. A. M.—Plants of the Chippewa National Forest and Itasca County, Minnesota..... 165
Pring, George H.—*Acineta chrysantha* Lindl. & Paxt. from horticulture 1
Sherff, Dr. Earl E.—Photographs of botanists..... 15
Wild, C. M.—*Solanum Dulcamara* L. and *Sabatia angularis* (L.) Pursh from Missouri..... 2
By Exchange—
O'Neill, Rev. Hugh, O. S. B.—Plants of Florida..... 121
New York Botanical Garden—*Oxypolis filiformis* (Walt.) Britt. from New Providence, Bahamas..... ,1
United States National Museum—Apocynaceae from Arizona 2

Total 1,562

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FLOWERING PLANT OF BRYOPHYLLUM PINNATUM

Missouri Botanical Garden Bulletin

Vol. XVI OCTOBER, 1928 No. 8

AN INTERESTING HOUSE PLANT

While it can hardly be called beautiful, the "life plant", *Bryophyllum pinnatum* Kurz., is so interesting and unique as to be worthy of more general use as a house plant. It is furthermore one of those hardy species, like the bow-string hemp (Sansevieria), that will stand the adverse conditions of life in a city apartment house. While it does best in a sunny greenhouse it will nevertheless flourish even in the north window of a city flat, and its lustrous green leaves are pleasant to look at during the winter months.

The chief interest of the life plant lies in its unusual method of perpetuation. In the notches of the leaves there are tiny buds, each of which, given the chance, can grow into a new plant. To make the buds sprout, nothing whatever is required except to detach the leaf from the parent plant, not even soil and moisture being necessary. In the juicy leaf alone there is enough nourishment to start the buds in their development. Though the young plants will grow a little faster if the leaf be placed in damp sand and kept well watered, they will develop even if the leaf is hung on the curtain of a sunny window. Within a week or two several buds will be seen to have sprouted. Their little leafy shoots will reach upward and their tiny, fibrous roots dangle down, and if the leaf is then placed in a pot of soil several of the nurslings will strike root and in a few weeks become husky young plants.

The first buds use up the nourishment in the leaf, and the others, though potentially as fertile, do not develop. Several long slashes made in the leaf when it is taken from the plant

will largely prevent the drainage of nourishment from one part of the leaf to another, and several small daughter plants can be developed instead of one or two large ones. Ordinarily this proliferation does not take place until the leaves have been removed, but occasionally on old pot-bound specimens buds will sprout on a leaf while it is still attached to the parent stem, as is shown in pl. 32, fig. 2. This habit is somewhat like that of an allied species, *Bryophyllum proliferum*. It sends out among the flowering branches little proliferous shoots, which if detached and placed in damp soil will give rise to new plants.

When grown as a house plant, the life plant seldom flowers, but if given more room, as in a greenhouse bench, for instance, it develops into a large specimen and flowers abundantly. While not particularly bright, the flowers are quite attractive and clean-looking. They are borne in large open panicles above the waxy leaves. The separate flowers are one to two inches long, with an inflated papery calyx of yellowish green and long protruding petals of dull red. A plant which flowered in the Desert House during the winter of 1926 is shown in plate 31.

The flowers set seed abundantly and the plants can be grown in that way, though leaf cuttings are so much easier and quicker that they should be used when they can be obtained. Stem cuttings are also easily made. The stems are merely cut into sections of a few nodes (joints) each, a pair of leaves being left at the top of each piece. The section is then stuck in damp sand or even garden soil, where it soon takes root. As a pot plant the species has no special requirements aside from a sandy-loam soil, a good-sized pot, and plenty of water. If the shoots are pinched back occasionally they will branch out, and a more attractively shaped plant will develop.

Bryophyllum pinnatum takes root so easily that it has become generally naturalized throughout the warmer parts of the world and is a common pan-tropic weed. Probably, however, like all the other members of the genus, it was originally native to the East Indies or Africa. St. Louisans need have

BRYOPHYLLUM PINNATUM

1. Potted plant. 2. Buds formed on leaf while still attached to the parent stem. 3. Detached leaf showing leafy shoots and roots.

NEST OF PURPLE GRACKLE IN DATE PALM

no fear of its becoming a pest in their gardens, for though it is a husky greenhouse subject, it is sensitive to frost and will not winter out of doors in this climate.

Bryophyllum has one particular use in which it is not excelled by any other house plant. It makes an excellent gift for a bed-ridden or crippled child, particularly if he be interested in flowers. It is hardy enough to grow in the sick room, and its method of developing new plants is so interesting to watch that it will help the young patient to forget his troubles.

BLACKBIRDS IN THE PALM HOUSE

During the spring and summer our common blackbird, the purple grackle, is a common sight in the Palm House. Strangely enough he does not seem particularly out of place among the palm trees; his raucous notes are rather like those of a parrot or macaw and harmonize well with the tropical setting. A few pairs build in this greenhouse every year, but their nests are usually placed so high up on the angle irons underneath the roof that they escape the notice of all but the most observant. This year, however, one pair accommodatingly built their nest in the lower branches (or, more strictly speaking, leaves) of a date palm opposite the main entrance.

From observations of previous years, when the birds have been seen to strip off loose fibres from the trunk and leaves of the palms, it might have been predicted that the nest would consist largely of palm fibres. Careful examination of the nest (illustrated in plate 33) proves this to have been the case. It is made up almost entirely of palm fibre, or coir, as it is usually called, and particularly noticeable are the flat flakes of brittle fibre from the leaf bases of the date palm. There are in addition a few bits of string and rag, which were probably picked up from the walks.

The blackbirds always make themselves very much at home and seem to have no difficulty in finding their way in and out of the high ventilators on the roof. This year a pane of

glass had a small hole in it, an opening which might have been thought too small for a full-grown blackbird to crawl through, much less fly through, but until it was repaired the birds used it as their main doorway and would dart in and out at full speed.

From time to time other birds were seen in the house, but the blackbirds always drove them out. A pair of cardinals which had been ejected in this way at last found a place for themselves in the Tropical Fruit House next door. Although no nest was seen, they apparently built one in the thick vines on the south wall. The old birds were often seen in that part of the house and a young bird was found fluttering about on the floor one morning.

THE FALL WEBWORM AND ITS CONTROL

August and September of 1928 saw the fall webworm (*Hyphantria cunea* Drury) more prevalent in the Middle West than it has been for many years. There was hardly a day but that at least one anxious inquiry was made at the Garden as to the name of the pest and the best measures for its control. The epidemic was not merely a local one; returning autoists told of having seen its unsightly webs very generally along the highways of the Middle West.

Unfortunately, the fall webworm does not confine itself to any one plant. It has been reported as feeding upon over 120 species of shade, ornamental, and fruit trees, and in seasons of abundance it is often found upon beets, spinach, and other field and garden crops. Few of our deciduous trees are immune from its attack, the only fortunate ones being the ginkgo and the tulip tree, which are seldom molested.

The insect gets its common name of "fall" webworm from the fact that in the northern states, where it was first known and studied, there is but one generation a year and it produces caterpillars whose webs are conspicuous in the late summer and fall. However, in this part of the country and further southward there are two generations. The moths

appear in April and May, and within three or four weeks lay their eggs in clusters on the upper and under sides of leaves. The caterpillars from this brood are full grown by midsummer and become the parents of the second generation of caterpillars which appears in late August and early September. These are the hairy caterpillars which have been so common in the city this summer and autumn. They are of a dull yellowish color and usually have a broad black stripe down the back. The long hairs with which they are clothed arise from rows of small black tubercles along the back and sides. Although the hairs are of a general yellowish brown appearance a close examination shows them to be black and white intermingled.

The web from which the species takes its popular name is most noticeable when the caterpillars are young. They start the web at the tips of branches and inclose within it a spray of leaves on which they feed. After the food within one web is exhausted they move away and start another, so that in a short time the tree on which they were hatched is covered with a number of unsightly webs, inclosing brownish masses of dead, partially eaten leaves.

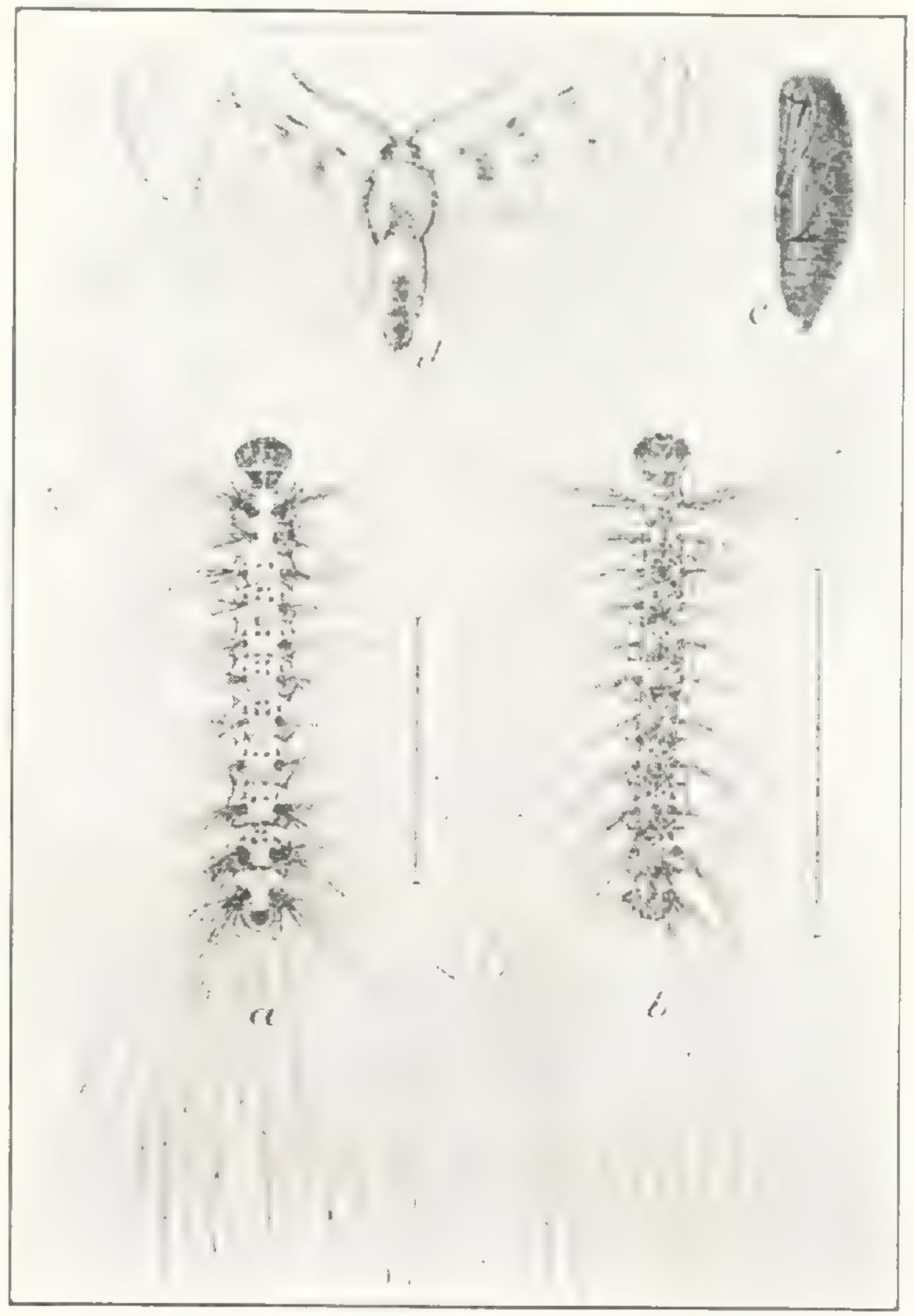
At the beginning of their larval existence the insects are gregarious, and live closely packed together, in colonies of several hundred individuals each, feeding side by side. As the larvae develop many of the young caterpillars are killed, and many are shaken or blown off the tree. The latter find a tree or bush up which to crawl and feed by themselves, so that by the end of September most of the webworms are feeding as separate individuals rather than in colonies. A month or six weeks after the eggs have hatched the caterpillars become full grown and crawl down the tree to make their cocoons for the winter in crevices of the bark or under litter on the ground. The cocoons are small, less than an inch long, and are flimsy structures of dirty silk combined with the hairs of the caterpillar. In this stage the insect passes the winter, to emerge next summer as a small white moth. The moths usually vary somewhat in their coloration, some being a pure white and others white with small black or dark brown spots on the wings.

Control.—The most generally useful means of control are the natural enemies, wasps and other insect parasites, birds (particularly the vireos), and fungous diseases. The fascinating story of how the natural enemies have effectively controlled all previous outbreaks will be told at greater length below, but before enumerating the various ways in which man can fight the pest it may be well to assure him that he will not be alone in the work and that the "epidemics" of the past have been controlled by natural means.

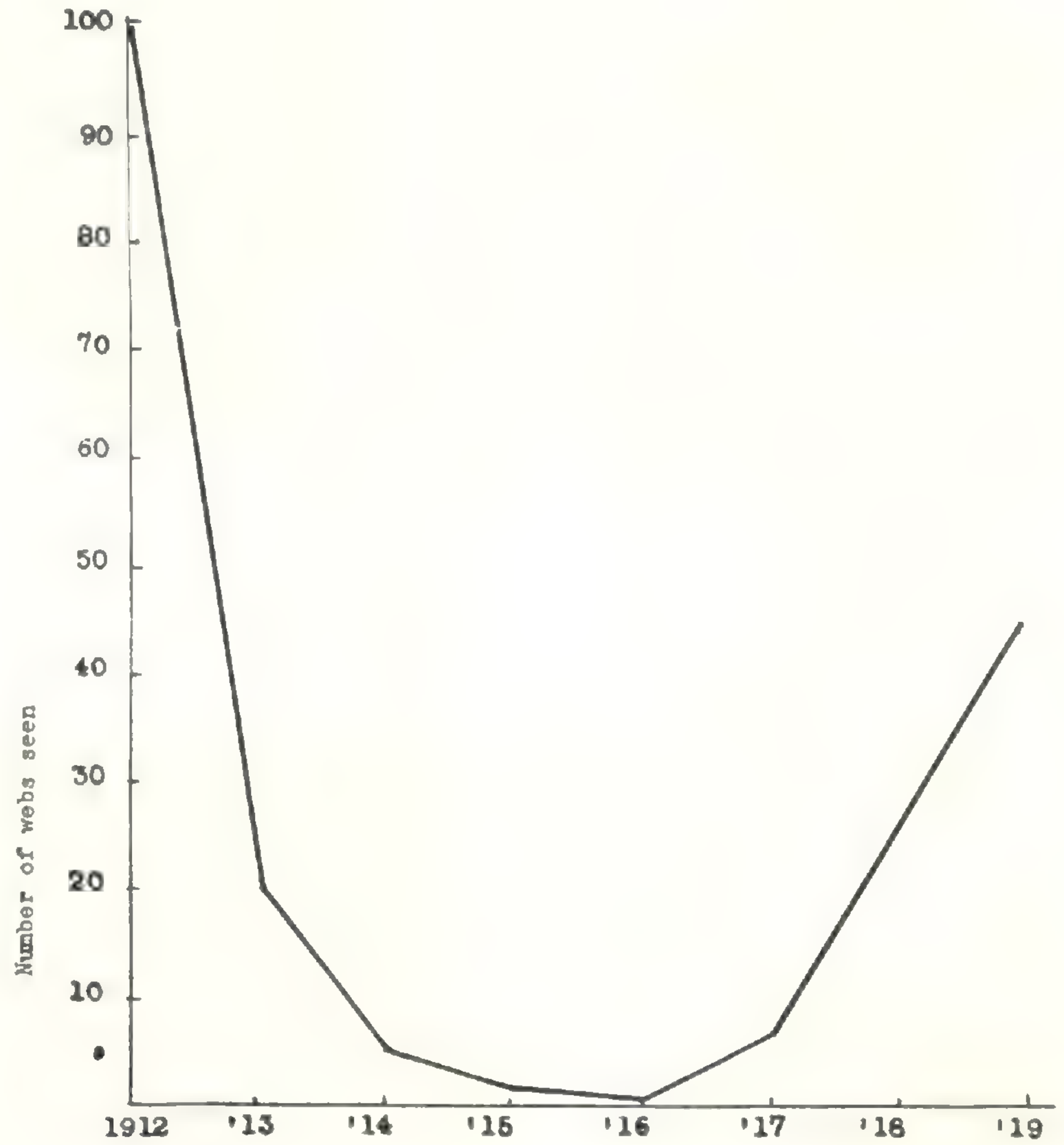
On a small place the webworm can be most easily controlled by destroying the webs when they first appear. At that time the young caterpillars are closely crowded together within the web and it is a relatively simple matter to destroy them, either by cutting off the branch or by donning heavy leather gloves and mashing the young caterpillars with the hands. While this may not be pleasant work it is more effective than the common practice of burning out the web. The latter method not only sometimes injures the tree but usually is only partially effective, since many caterpillars are merely singed and recover in a short time. Spraying with a poison spray is also effective when done early in the season. For this, arsenate of lead is most commonly used in the proportion of four pounds to fifty gallons of water. It should be applied as soon as the webs are noticed, not only to the trees on which the webs are located but to all other trees and bushes in the immediate vicinity.

Natural control.—It has been known for some time that the fall webworm is one of those insects which increase and decrease so regularly from year to year that one may almost refer to the outbreaks as waves. Severe outbreaks have, for instance, been reported in the Middle West for the years 1865-70, 1882-88, 1894-96, 1900-1909 and the present year. Each wave has reached alarming proportions only to be followed by a long period in which the insect was of relative unimportance.

It was known in a general way that these waves recorded the struggle between the insect and its various enemies, the peaks of the waves representing periods when the webworm



ADULT PUPA AND LARVAE OF FALL WEB-WORM (after Howard)



RELATIVE PREVALENCE OF FALL WEBWORM IN NEW BRUNSWICK, FROM 1912 TO 1919

MO. BOT. GARD. BULL., VOL. 16, 1928.

was gaining on its various parasites, and the troughs of the waves those times when the enemies were holding the insect severely in check. As to how these parasites operated and as to the actual reasons for any specific outbreak, little was known, however. The problem was taken up by Dr. John Tothill of the Canadian Department of Agriculture, and his report on the "Natural Control of the Fall Webworm" is a fascinating story of conditions in eastern Canada from 1912 to 1920. The work was so carefully done and the field so completely covered that he was able to record the relative prevalence of the insect from year to year with a high degree of accuracy and to put his finger on the exact causes which made it decline from 1912 to 1916 and increase from 1916 to 1920.

It was first of all necessary to devise some exact method of measuring the relative prevalence of the webworm from year to year. This was accomplished by counting, each year, the actual number of webs seen along a selected eighty miles of roadside. The result of this eight-year census is given graphically in the accompanying diagram (pl. 34). It shows how quickly and completely the 1912 outbreak was brought under control once the parasites had gained headway. Where in 1912 one hundred webs had been seen, only thirty were found the following year and by 1916 extensive search produced only one. The insect then seemed on the verge of extinction but a long-distance flight of moths from outside the area studied (New Brunswick) brought in fresh recruits.

The greater part of Dr. Tothill's eight-year study was taken up in discovering what parasites were responsible for keeping the webworm under control and in what manner they operated. His final conclusions were as follows: "In the time of an outbreak the parasites were unable to cope with the situation and some years were necessary for them to breed up to a condition of usefulness. The role of the parasites is not to check an incipient outbreak. Again, when the host become exceedingly scarce, the parasites died away and under such conditions they were largely ineffective. When the host was but moderately abundant, however, the maximum

usefulness of the parasites was developed and they became largely responsible for a condition of stabilized control in which the insect neither increased nor decreased but remained for a considerable period of years as a comparatively harmless member of the fauna. * * * The tremendously important part played by vireos in Eastern Canada and by undetermined birds in British Columbia in the control of Hyphantria has also been narrated during the progress of this study. They are of least importance when the host insect is very abundant; of greatest importance when the webs are very scarce; and they share with the parasites the task of maintaining a stabilized control when the insect is just moderately abundant. Without the birds the parasites would not maintain a control."

What are these insect parasites? They are of different sorts; Dr. Tothill found eight important ones in his study. Three of these were tiny flies which laid their eggs (or in one case their young) within the larvae of the young webworms. The others were parasitic wasps. One of these, Therion, is a comparatively large species about an inch long which lays its eggs in the nearly full-grown caterpillars of the webworm. There they develop slowly, living over the winter within the caterpillar's cocoon and hatching out the next summer. The remaining four enemy parasites are small wasps whose larvae develop inside the bodies of the young webworm caterpillars, much as do the larvae of the fly parasites.

NOTES

Dr. Edgar Anderson, Geneticist to the Garden, spoke before the Webster Groves Nature Study Society, October 5, on "The Wider Possibilities of Nature Study."

Among the recent visitors to the Garden were Dr. D. N. Kashkarov, professor of zoology, Middle Asiatic State University, Tashkent, Russia; and Mr. J. H. Gurley, Chief, department of horticulture, Ohio Agricultural Experiment Station, Wooster, Ohio.

Dr. George T. Moore, Director of the Garden, spoke before a meeting of the women of the Union Avenue Christian Church, October 11, on "The Service of the Missouri Botanical Garden to the Public."

The British journalists who were guests of the St. Louis Newspaper Publishers' Association, October 15-19, visited the Garden, October 16, and were conducted through the grounds and buildings.

Mr. G. H. Pring, Superintendent of the Garden, has given the following lectures recently: October 8, before the University City Masonic Temple Women's Club, on "Orchid Exploration"; October 10, before the St. Louis Association of Gardeners, "Spraying"; October 12, before the South Kirkwood Garden Club, "Fall Planting."

On the morning of October 13 a kingfisher, chased by a larger bird, flew against one of the herbarium windows with such force that he broke through the heavy glass. His speed was so great that he made a fairly clean round hole and escaped injury. When taken outdoors he immediately flew away to the lake in the North American tract.

Amos M. Showalter, A. B. (Goshen College, Indiana, 1918); A. M. (University of Wisconsin, 1920); Ph. D. (*Ibid.*, 1924); Exchange Fellow, Commission for Relief in Belgium, Educational Foundation, 1922-24; National Research Fellow, 1924-27, has been appointed Assistant Professor of Botany in Washington University.

During the summer of 1927 bees which escaped from the hives at the Garden made an unusual nest which was described in the December, 1927, number of the BULLETIN. Several unprotected nests have been built in the branches of a small hawthorn tree during the summer of 1928, and although much smaller than that of last year are similar in general construction.

The young women listed below, from the St. Louis School of Occupational Therapy, are taking a course in gardening on Tuesday and Thursday afternoons under Dr. Edgar Anderson, Geneticist to the Garden: Harriet Barnes, Helen Barnum, Mary Britton, Stella Earnest, Olga Halwe, Jane

Myers, Irene Obrock, Jane Rawson, Charlotte Steiner, Huldah Steinmesch, Laura Nielsen.

The following clipping, antedating 1873, was found by Mr. George T. Parker, of this city, in an old book belonging to his father:

St. Louis and the Missouri Botanical Garden.

Correspondence of Elizur Wright in the Boston Commonwealth.

* * * * * * * * * *

I have never been more impressed with the importance of suburban nature to the city than on a recent visit to the great central city of the continent, St. Louis. Being the pivot upon which east and west, north and south, balance, it has a back country which is itself the very garden-spot of the continent. It is a city surrounded with a forest of corn fields. At the time I saw them, troops of cavalry might have ridden into these corn fields, and their plumes would have been quite out of sight under those of the corn. But corn, oats, grass and potatoes were not the only wonders of that fertile soil. On the fine elevated ground, overlooking the city from the west, and not, I think, more than four miles from its centre, is an enclosure of many acres, grandly walled, and adorned with various elegant structures of the western marble. Creepers pour over the walls from within, and hang out their gay banners in tropical profusion. This is the St. Louis Botanical Garden, and though it seems worthy of a much larger and older city, you are surprised to find that it is the property of a single person, Mr. Henry Shaw, who to a life of business, has added this life study of flower and fruits. But the gates, which are imposing enough for a medaeval palace, are freely opened two days in the week to all visitors, and there seems to be no lack of them, going on foot or riding in coaches. A description can do no justice to the interior of such a place, and will not be undertaken.

The following appointments have been made in the Shaw School of Botany for the academic year 1928-29: Miss Catharine Mary Lieneman, A. B., M. S., Instructor in Botany; Miss Caroline K. Allen, A. B., Assistant in Botany; Miss Martha L. Beardsley, A. B., M. S., Assistant in Botany; Hamilton H. Card, A. B., Assistant in Botany; Miss Josephine Darlington, A. B., B. S., Assistant in Botany; Alexander F. Bucholtz, B. S., Rufus J. Lackland Fellow; Miss

Julia A. Lawrence, A. B., Rufus J. Lackland Fellow; Robert E. Woodson, Jr., A. B., M. S., A. M., Rufus J. Lackland Fellow; Miss Marion Child, A. B., Jessie R. Barr Fellow in Botany; Miss Mildred E. Mathias, A. B., M. S., Jessie R. Barr Fellow in Botany; and Mrs. Eva M. Fling Roush, A. B., A. M., Jessie R. Barr Fellow in Botany.

At a meeting of the Board of Trustees of the Garden, held on November 17, Mr. Gurney Wilson, F. L. S., of England, was appointed representative of the Garden in Europe. Mr. Wilson is editor of the "Orchid Review," the only publication of its kind in the world. He is secretary of the orchid committee of the Royal Horticultural Society and acting secretary of the Rhododendron Association of England. He will represent the Garden at the more important flower shows held abroad, securing plant novelties which will be grown from seed and exhibited in the floral displays at the Garden. It is believed that his contacts with the principal commercial and amateur growers will afford a most important addition to the activities of the Garden. He will likewise assist in securing books and pamphlets needed for the Garden library and in various other ways help to bring the Garden into closer relationship with the horticultural and botanical institutions of the Old World.

The September number of the ANNALS OF THE MISSOURI BOTANICAL GARDEN, which has just been issued, is devoted to an article by Dr. Edgar Anderson, Geneticist to the Garden, on "The Problem of Species in the Northern Blue Flags, *Iris versicolor L.* and *Iris virginica L.*" Dr. Anderson has found that the common "blue flag" of eastern North America is in reality made up of two species; one, the true *Iris versicolor*, is native to Canada and the northeastern states, the other, *Iris virginica*, inhabits the southeastern states and the Mississippi Valley. Though distinguished and described by Linnaeus, they have been extensively confused since his time, but Dr. Anderson's painstaking work has shown that they are really very different when carefully examined. His main concern has been to make an intensive survey of the variation within the two species, studying them from the Gulf States to northern Canada, and from Missouri to Massachusetts. He

finds that, although each species varies widely in every locality in which it has been studied, within either of the species the general average of each locality is practically the same. In other words, his work points to the conclusion that the variation between individuals is apparently of little evolutionary importance.

STATISTICAL INFORMATION FOR SEPTEMBER, 1928

GARDEN ATTENDANCE:

Total number of visitors	39,504

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	30
Total number of books and pamphlets donated	513

PLANT DISTRIBUTION:

Total number of plants and seeds donated	5

HERBARIUM ACCESSIONS:

By Purchase—

Larsen, Miss Esther L.—Plants of Montana and North Dakota	178
Weigel, Theodor Oswald—Jaap, "Myxomycetes Exsiccati," Series I, Nos. 1-20; II, Nos. 1-15; III, Nos. 1-15	50
Weigel, Theodor Oswald—Plants of Bolivia collected by O. Buchtien, Lieferung IV, 1-2 Hälfte; Lieferung V, 1-2 Hälfte	200

By Gift—

Anderson, Dr. E.—Plants of North Carolina and South Carolina	21
Epling, Dr. Carl C.—Fragment of authentic specimen of *Apocynum Hendersoni* Hook. f. from Turkestan	1
Featherly, Prof. H. I.—*Solanum nigrum* L. from Oklahoma	1
Linder, Dr. D. H.—Higher basidiomycetes of Valley Park	18
Mathias, Miss Mildred—Ferns of Vermont	4
McAdams, Clark—*Diplidis diandra* (Nutt.) Woods from St. Charles, Missouri	1
Pring, George H.—*Nepenthes Balfouriana* from Horticulture	2
von Schrenk, Dr. Hermann—Plants of Nova Scotia	15
Wagner, Rev. Alex.—Plants of Missouri	2

By Exchange—

Jardin Botanique de Nikita—Plants of Taurica	61
Total	554

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Vandeventer avenue car line (No. 33). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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AMERICAN BOTANICAL GARDENS AND ENGLISH POETRY

The connection between English poetry and American botanical gardens seems hardly worth considering, yet in one particular instance it was a very direct and lively one. For into the published journal of William Bartram, Wordsworth and Coleridge dipped again and again, unconsciously carrying away whole phrases as well as technical information. In this way the record of a plant-collecting trip sent out by an American botanical garden became transmuted into some of the noblest lines of English poetry.

The journal, or to give its full title, "Travels through North and South Carolina, Georgia, east and west Florida, the Cherokee country, the extensive territories of the Muscogulges or Creek Confederacy, and the country of the Chactaws," was the product of William Bartram, the first botanist to visit the southern Alleghenies. He was the son of John Bartram, the Quaker farmer of Pennsylvania who through his own efforts became the first native American botanist and explorer, a correspondent of Linnaeus and other eminent botanists, and a charter member of the American Philosophical Society. John Bartram founded the first American botanical garden on the banks of the Schuylkill in what is now the city of Philadelphia,—a botanical garden that remains to-day as part of the park system of that city and which contains some very remarkable old trees planted by the two Bartrams.

It was at the request of one of John Bartram's English correspondents, another Quaker, the distinguished Dr. John

Fothergill, that William set out on his collecting trip through the South. Dr. Fothergill's letter of instructions is still extant and in addition to general directions contains some pithy advice for the youg man:

"I should be very glad to contribute to thy assistance in collecting the plants of Florida, if thou would suggest what terms might be agreeable. That no time, however, may be lost, I shall desire Dr. Chalmers to confer with thee on this subject, and to render such assistance as may be immediately wanted.

"As I imagine thou art well acquainted with the method of packing up plants and seeds, I shall say not much on this head. All bulbous roots are easily managed.

"Mind thy studies in drawing. Thy hand is a good one, and by attention and care may become excellent.

"Avoid useless or improper company. Be much alone, and learn to trust in the help and protection of Him who has formed us, and everything. Fear Him and He will raise thee friends, and keep thy foot from sliding."

That William may have needed an occasional reminder to stick to his botany is evidenced by a letter written to him at Cape Fear by his father at about the same time:

"Thee disappointed my expectations much in not sending me any seeds by Capt. Sharpless; and I know your seeds were, some or other, within a mile or two of thy common walks. And yet I have not received one single seed from my son, who glories so much in the knowledge of plants, and whom I have been at so much charge to instruct therein. I don't want thee to hinder thy own affairs to oblige me; but thee might easily gather a few seeds, when thee need not hinder half an hour's time to gather them, or turn twenty yards out of thy way to pluck them."

Young Bartram started out on his trip in April, 1773, and was gone nearly five years, returning home in January, 1778. In that time he journeyed through Georgia, Florida, Alabama, and Mississippi, collecting seeds and specimens which he forwarded to Fothergill, and visiting the many Indian settlements which then existed in the Southeast.

His travel book was published in Philadelphia in 1791 and was soon after reprinted in London and elsewhere. It had a tremendous vogue and rightly so, for though it was an accurate and scientific account of the geography, fauna, and flora of the region he visited, it was then, and still is, interesting reading. Carlyle, in recommending the book to Emerson, described it as having "a wonderful kind of floundering eloquence." Bartram was "more than half a poet," and even his scientific descriptions are imaginative and stimulating, as the following excerpts testify:

"There are some rich swamps on the shores of the island and these are verged on the outside with large marshes, covered entirely with tall grass, rushes, and herbaceous plants; amongst these are several species of Hibiscus, particularly the hibiscus coccineus. This most stately of all herbaceous plants grows ten or twelve feet high, branching regularly, so as to form a sharp cone. These branches also divide again, and are embellished with large expanded crimson flowers. I have seen this plant of the size and figure of a beautiful little tree, having at once several hundred of these splendid flowers which may be seen at a great distance. They continue to flower in succession all summer and autumn, when the stems wither and decay; but the perennial root sends forth new stems the next spring, and so on for many years."

Or take his description of the papaya: "This admirable tree is certainly the most beautiful of any vegetable production I know of; the towering Laurel Magnolia, the exalted Palm, indeed exceed it in grandeur and magnificence, but not in elegance, delicacy and gracefulness. It rises erect to the height of fifteen or twenty feet, with a perfectly straight tapering stem, which is smooth and polished, of a bright ash colour, resembling leaf silver, curiously inscribed with the footsteps of the fallen leaves; and these vestiges are placed in a very regular uniform imbricated order; which has a fine effect, as if the little column were elegantly carved all over."

His descriptions of the southeastern Indians were published at a time when Europeans were interested in America

and in wilderness life. They still remain the best first-hand account of conditions at that time.

Chief among the English writers to whom the book appealed were the lake poets, Wordsworth and Coleridge. Wordsworth was at this time amplifying his own experience by reading largely in geography and travel. Most particularly was he interested in accurate first-hand accounts of life in other parts of the world. We find him writing to Archdeacon Wrangham at this time: "The only modern books that I read are those of travel or such as relate to matters of fact". A study of his reading during these early years shows that within a few years he "read accounts of Dalecaria, Lapland, and northern Siberia; he studied in some form the physical geography of portions of south-eastern Europe; he made acquaintance, it seems, with Wilson's *Pelew Islands*; he read Hearne's *Hudson's Bay* 'with deep interest', and knew the Great Lakes through the *Travels* of Jonathan Carver. If he did not carry Bartram's *Travels* in Georgia, Florida, etc., with him to Germany, he must have had that entertaining journal almost by heart before he started. In this book, of course, his interest in travel was re-enforced by his interest in botany."

The subject matter, and in the case of Bartram, whole phrases, passed over unconsciously into his poetry. In Book Third of his "Prelude", "with a censuring eye upon the Cambridge of his day and its uninspiring landscape," he describes the surroundings of a university as they ought to be:

> "A primeval grove,
> Where, though the shades with cheerfulness were filled,
> Nor indigent of songs warbled from crowds
> In under-coverts, yet the countenance
> Of the whole place should bear a stamp of awe;
> A habitation sober and demure
> For ruminating creatures; a domain
> For quiet things to wander in; a haunt
> In which the heron should delight to feed
> By the shy rivers, and the pelican
> Upon the cypress spire in lonely thought
> Might sit and sun himself."

FRONTISPIECE FROM BARTRAM'S "TRAVELS."

"The whole passage," says Cooper, "ruminating creatures, pelican, cypress spire and all—is a remarkable adaptation of a scene depicted by the Quaker botanist, William Bartram, on the banks of the Altamaha in Georgia." In the passage alluded to, Bartram says: "I ascended this beautiful river on whose fruitful banks the generous and true sons of liberty securely dwell. My progress was rendered delightful by the sylvan elegance of the groves, cheerful meadows, and high distant forests. The winding banks of the river, and the high projecting promontories, unfolded fresh scenes of grandeur and sublimity. The deep forests and distant hills re-echoed the cheering social lowings of domestic herds. The air was filled with the loud and shrill whooping of the wary sharp-sighted crane. Behold, on yon decayed, defoliated cypress tree, the solitary wood pelican, dejectedly perched upon its utmost elevated spire; he there, like an ancient venerable sage, sets himself up as a mark of derision, for the safety of his kindred tribes."

Nor is this passage from the "Prelude" a solitary example. "A tinge of Bartram is visible in the lines *There was a boy,* in the *Stanzas written in my Pocket-Copy of Thomson's 'Castle of Indolence,'* in *She was a Phantom of Delight,* in part of *The Prelude* and *The Recluse.*" Perhaps the most conspicuous example is Wordsworth's "Ruth," where he often follows Bartram word for word, and where one of the chief characters is evidently described from Bartram's frontispiece, a portrait of Chief Mico Chlucco of the Seminoles, which we have reproduced in plate 36.

Compare this picture with Wordsworth's description of the young hero of the poem.

"There came a youth from Georgia's shore—
A military casque he wore,
With splendid feathers drest;
He brought them from the Cherokees;
The feathers nodded in the breeze,
And made a gallant crest."

Furthermore, the whole poem is saturated in Bartram. The following comparisons are typical of many more that might be made.

BARTRAM.	WORDSWORTH.
"Gordonia lacianthus gradually changing colour, from green to golden yellow, from that to a scarlet, from scarlet to crimson, and lastly to brownish purple, so that it may be said to change its garments every morning."	. . . . "He spake of plants that hourly change Their blossoms through a boundless range Of intermingling hues; With budding, fading, faded flowers, They stand the wonder of the bowers From morn to evening dews."
"North and south almost endless green plains and meadows, embellished with islands of high dark forest."	The Youth of green savannahs spake And many an endless, endless lake With all its fairy crowds of islands.

In the case of Coleridge the connection between the original readings and the poetry is more obscure. Bits from various sources are so fused and blended together that "all the king's horses and all the king's men cannot put together the scattered fragments." It is doubtful if Bartram's influence could be traced at all, had not Coleridge himself left us the guide-book which will take us from his original reading, through the rich disordered maze of his mind, to the haunting music of "Christabel" and "Kubla Khan." Lowes has told the story in his "Road to Xanadu."

*"In the British Museum is a small manuscript volume of ninety leaves, which is one of the most illuminating human documents even in that vast treasure house. It is a note book kept by Coleridge, partly in pencil, partly in ink, and always with the most admired disorder. Its value is incalculable, not only for the understanding of Coleridge, but also as a docu-

---

*Note: Considerations of space have necessitated a severe abridgment of Dr. Lowes' rich account.

ment in the psychology of genius, and as a key to the secrets of art in the making. It is the strangest medley that I know. Shelley's note books written upside down, sidewise, and even right side up, with their scribbled marginal sketches of boats and trees and human faces—these battered and stained and happy-go-lucky little volumes are a priceless record of the birth-throes of poetry. But it is chiefly poetry which they contain. There are few notes of Shelley's reading. But not the Coleridge Note Book. It is a catch-all for suggestions jotted down chaotically from Coleridge's absorbing adventures among books. It is a repository of waifs and strays of verse, some destined to find a lodgment later in the poems, others yet lying abandoned where they fell. And it is like nothing else in the world so much as a jungle, illuminated eerily with patches of phosphorescent light, and peopled with uncanny life and strange exotic flowers. But it is teeming and fecund soil and out of it later rose, like exhalations, gleaming and aerial shapes.

"Without more ado, then, let us plunge into the wilderness which the strange document before us exhibits. On the heels of a pit of poetized observation of snow curling in the breeze comes without warning 'the alligators' terrible roar' and the captivating entry thus proceeds:

> The alligators' terrible roar, like heavy distant thunder, not only shaking the air and waters, but causing the earth to tremble . . . . .
>
> 20 feet long — lizard-shaped—, plated — head vulnerable— tusked—eyes small and sunk—
>
> Hartley fell down and hurt himself—I caught him up crying and screaming—and ran out of doors with him. The Moon caught his eye—he ceased crying immediately—and his eyes and the tears in them, how they glittered in the Moonlight.
>
> Some wilderness-plot, green and fountainous and unviolated by Man.
>
> The distant thunder sounds heavily—the crocodiles answer it like an echo—.

"Now Coleridge got his alligators from one of the most delightful books which he or anybody every read, William Bartram's *Travels*. There is much more of the title, but just now the crocodiles and not Bartram hold the stage. Coleridge

wanted his alligators badly, but even his genius found them a trifle intractable as boon companions for moths in the moonlight, and in the strange and demon haunting setting to which he finally transferred them they stubbornly declined to stay. Poor little Hartley, sandwiched weeping between their layered egg-heaps and their thundering roar, he extricated later in the closing lines of 'The Nightingale.' And the green and fountainous wilderness-plot belongs in the complicated history of 'Kubla Khan.'

"From the exciting domestic life of alligators Coleridge now passes to exotic plants:

> Describe—
>
> —the never-bloomless Furze—
>
> and then transi to the Gordonia Lasianthus. Its thick foliage of a dark green colour is flowered over with large milk-white fragrant blossoms on long slender elastic peduncles at the extremities of numerous branches . . .

"The never-bloomless furze later found a modest place in 'a green and silent spot, amid the hills' where 'Fears in Solitude' was written. The Gordonia wasted its sweetness on the desert air as far as Coleridge is concerned, for he never used it, though Wordsworth, in a poem fairly steeped in Bartram, did."

And so on for entry after entry in the Note Book. Dr. Lowes' scholarly work has shown how these fragments from Bartram and from many another corner, "things fantastic as the dicing of spectres on skeleton-barks, and ugly as the slimy spawn of rotting seas, and strange as a star astray within the moon's bright tip, blend into patterns of new created beauty."

So even the journal of a botanical expedition emerged at last in:

> "And there were gardens bright with sinuous rills
> Where blossomed many an incense-bearing tree;
> And here were forests ancient as the hills
> Enfolding sunny spots of greenery."

WINTER PROTECTION OF PLANTS FOR ST. LOUIS CONDITIONS

Our Missouri climate is a capricious one, and bringing plants through the winter in good condition is more of an art than a science. Like so many phases of gardening, much that is written in the books on the subject is of little use under St. Louis conditions, and the St. Louis gardener must work out his own methods. The Missouri Botanical Garden has accordingly been experimenting for the past several seasons with different types of winter protection. Much still remains to be learned, but enough experience has been accumulated to make the former treatment of this subject (October, 1918, BULLETIN) quite out of date. The following general account of winter protection has therefore been prepared for the guidance of local gardeners.

Unfortunately much of the winter protection given plants in this locality at present is time wasted and money thrown away. Attempts are made to winter tender plants that cannot stand our zero spells. Other plants are protected so heavily that they rot during warm wet spells or start growth too early in the spring and are frozen back.

The function of a protective dressing lies chiefly in its reduction of evaporation, which is excessive during dry cold weather when the ground is frozen hard. Being frozen, the roots cannot respond to the drain upon the plant's system, and those parts of the plant exposed to the drying action of the air are consequently shriveled. A mulch serves another useful purpose in preventing the practice of alternate freezing and thawing, which is particularly injurious when plants are in heavy soil, as it causes them to be heaved out of the ground. Also, excessive packing of the ground, through the action of ice and snow, is prevented and the tender bark is protected from the unscreened rays of the winter sun.

For most trees and shrubs a mulch is not necessary unless they have just been planted. In that case 4–6 inches of well-rotted manure or straw are placed over the roots after planting. If planting is not to be done until spring, the trees or shrubs may be "heeled in" over the winter; *i. e.*, the roots are

laid in a shallow trench, covered with well-drained soil, and later given a covering of straw.

Native roses, as well as many of the hardy Chinese kinds, need no covering, but the various hybrid types, such as hybrid perpetuals, hybrid teas, teas, etc., will not stand our winters unless a measure of protection is afforded. The climbers, being largely the offspring of the hardy Wichuriana and multiflora types, are seldom injured except during unusually severe winters. Experience at the Garden has shown that the method of pegging down the flowering canes of these climbers and covering them with soil is not to be recommended for St. Louis. For our conditions, it is better to use loose straw, cornstalks, or the dried tops of tall ornamental grasses. They should be tied around the rose canes in such a manner as to break the force of the wind and shut off the rays of the sun, but loosely enough to allow a good circulation of air.

The tender bush roses should be protected by hilling loose soil around each plant to a depth of 6–8 inches and covering the entire bed with straw. Oak leaves may be used if they are covered with something that will shed the water, otherwise they will become too soggy during wet weather. However, straw is much better if it can be obtained. In the past it has been generally recommended that roses be mulched with a mixture of straw and well-rotted manure. Experience at the Garden has demonstrated that straw alone is much better for St. Louis conditions. It dries out quickly during the warm damp weather we occasionally get during the winter, whereas heavier materials hold the water and induce rot.

Due to the way our winters vary from year to year, no absolute rule can be laid down as to when the rose garden should be given its winter overcoat. For hybrid teas, some time in the latter part of November is to be recommended. For herbaceous perennials, little mulching is required besides their natural covering of dead branches and leaves. Our worst trouble in this locality is the "heaving" which occurs on heavy clay soils, and to some extent on all of our loams. A light mulch 2–3 inches deep will help to prevent this. Young herbaceous perennials and pansies are best wintered over in cold-frames.

During severe weather the frames should be protected with straw mats. These should be removed during warm spells in order to keep the plants from starting growth too soon.

NOTES

Dr. Edgar Anderson, Geneticist to the Garden, spoke before the Kirkwood Garden Club, November 23, on "Irises for the Home Garden".

Dr. Edgar Anderson served as examiner of the Girl Scouts for the Tree Finder Merit badges, November 20.

A specimen of *Agave attenuata,* in the west end of the Succulent House, is now in bloom. This is one of the few spineless species of Agave.

Among those visiting the Garden recently were Prof. E. M. East, professor of plant genetics, Bussey Institution of Harvard University; Dr. L. O. Kunkel, pathologist, Boyce Thompson Institute, Yonkers, N. Y.; and Dr. H. L. Shantz, president, University of Arizona, Tucson.

Nearly 25,000 people viewed the Florists' Show, held in the Floral Display House at the Garden, November 8-11. The conservatory was open in the evenings during this show, and on the evening of November 11 the attendance was over one thousand.

A half-dozen blossoms of the bird-of-paradise plant, *Strelitzia Reginae,* shipped from Pasadena, California, arrived at the Garden on the opening day of the Florists' Show, November 8. They were exhibited in the Floral Display House until November 22, when they showed signs of withering, having lasted about nineteen days. The flowers were shipped in a corrugated box without packing except that the stems were wrapped in sphagnum moss and covered with oiled paper.

The 1928 Chrysanthemum Show has eclipsed all its predecessors in its unique setting, in the skillful blending of colors, and in the perfection of the individual flowers. The entire Floral Display House was converted into a Japanese garden. Bamboo fencing along the wall, a rush-thatched gateway at the rear, small "tori" gates at the front entrance, and an old

stone lantern served as stage properties. With these as a background and with the display arranged in many small beds the illusion of a garden was perfect. The colors were harmoniously blended, although they included everything from fire-red to pale pink. In the beds along the wall tawny red and yellow shades predominated, toning in well with the bamboo fencing and the dark stained wood of the gateways. Pale yellow and white in the adjacent beds served to lead the eye without a clash to the central beds where pink was the predominating color. The flowers themselves were in splendid condition. An unusually large number of hanging baskets and several large specimens displayed singly helped to give the air of a garden.

STATISTICAL INFORMATION FOR OCTOBER, 1928

GARDEN ATTENDANCE:

Total number of visitors.....38,352

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 47
Total number of books and pamphlets donated..... 677

PLANT DISTRIBUTION:

Total number of plants and seeds donated..... 14

HERBARIUM ACCESSIONS:

By Purchase—

Broadway, W. E.—Plants of Trinidad and Tobago..... 100
Mexia, Mrs. Ynez—Plants of Mexico..... 697
Weigel, Theo. Oswald—Plants of Bolivia, collected by Dr. O. Buchtien..... 500

By Gift—

Anderson, Dr. E.—Plants of Michigan, etc..... 34
Ashton, Miss Ruth E.—Ferns from the Rocky Mountain National Park..... 3
Bettis, Mrs. James R.—Plant from Mississippi..... 1
Featherly, Prof. H. I.—*Perilla frutescens* (L.) Britt. from Oklahoma 1
Hume, H. Harold—Plants of Florida..... 2
Gilmour, Joseph—Plants of Ontario, Canada..... 10
Jerome, O. S. B., Father—Plants of Florida..... 2
Johnson, Clinton G.—Specimen of *Artemisia*..... 1
Krebs, Mrs. Heinrich Friedrich—Plants of Ontario, Canada 18
Mathias, Miss Mildred—Plants of Missouri..... 20
von Schrenk, Dr. Hermann—*Actinomeris alternifolia* (L.) DC. from Missouri..... 1

By Exchange—

Lillo, Dr. Miguel—Plants of South America..... 120
Merrill, Dr. E. D.—Plants of Mongolia, collected by Dr. R. W. Chaney..... 178
New York State Museum, by Dr. H. D. House—Plants of New York 129
University of Pennsylvania, collected by John M. Fogg, Jr.—Plants of eastern United States..... 290

By Field Work—

Greenman, Dr. J. M.—Plants of Illinois and Missouri.... 10

Total 2,117

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Vandeventer avenue car line (No. 33). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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PLATE 87.

EXPERIMENTAL PLOTS IN THE NURSERY. THE EIGHT PLOTS IN THE FOREGROUND PLANTED IN SEPTEMBER, 1927, WITH VIVIPAROUS BENTS AND VARIOUS GRASS SEED. FERTILIZER TESTS ARE BEING CARRIED ON BETWEEN PEG MARKERS.

Missouri Botanical Garden Bulletin

Vol. XVI DECEMBER, 1928 No. 10

CREEPING BENT FOR ST. LOUIS LAWNS

In the BULLETIN for September, 1925, there appeared an article on "A new lawn grass for St. Louis." The demand for this bulletin was unexpectedly large, and it has been out of print for some time. Interest in the subject has continued to grow, however, and numerous inquiries are received, requesting information on the use of creeping bent. During the past three years much additional information has been gradually accumulated, and it would seem that the time has come for a more elaborate treatment of the bent-grass lawn problem.

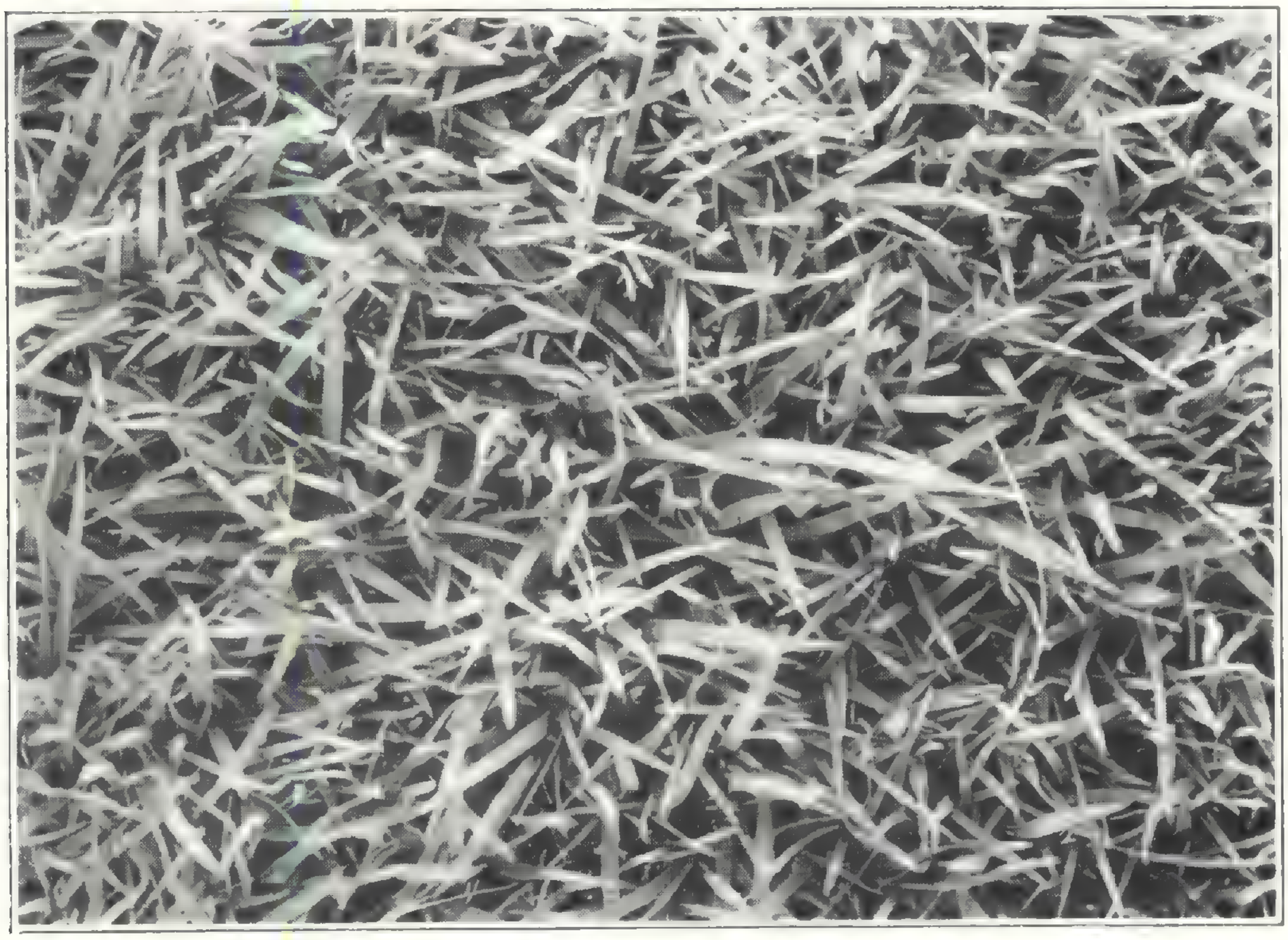
It is necessary to reprint a part of the original article in this number of the BULLETIN in order to make the discussion complete, particularly since the earlier article can no longer be obtained.

The problem of securing a satisfactory lawn grass in St. Louis has always been a perplexing one and probably always will be unless more money and effort are devoted to it than the average individual is willing to spend. In the past about the best combination which has been devised for lawns in this region was a mixture of blue grass and red top with sometimes the addition of white clover. St. Louis lies at practically the southern boundary of the zone in which blue grass will flourish, and it is only during exceptional seasons that lawns made up chiefly of this grass can be said to be worthy of the name. One has only to observe the way in which blue grass grows in partially shaded locations to realize how delicate is the balance between success and failure during one of our average summers. Perfect stands of blue grass can fre-

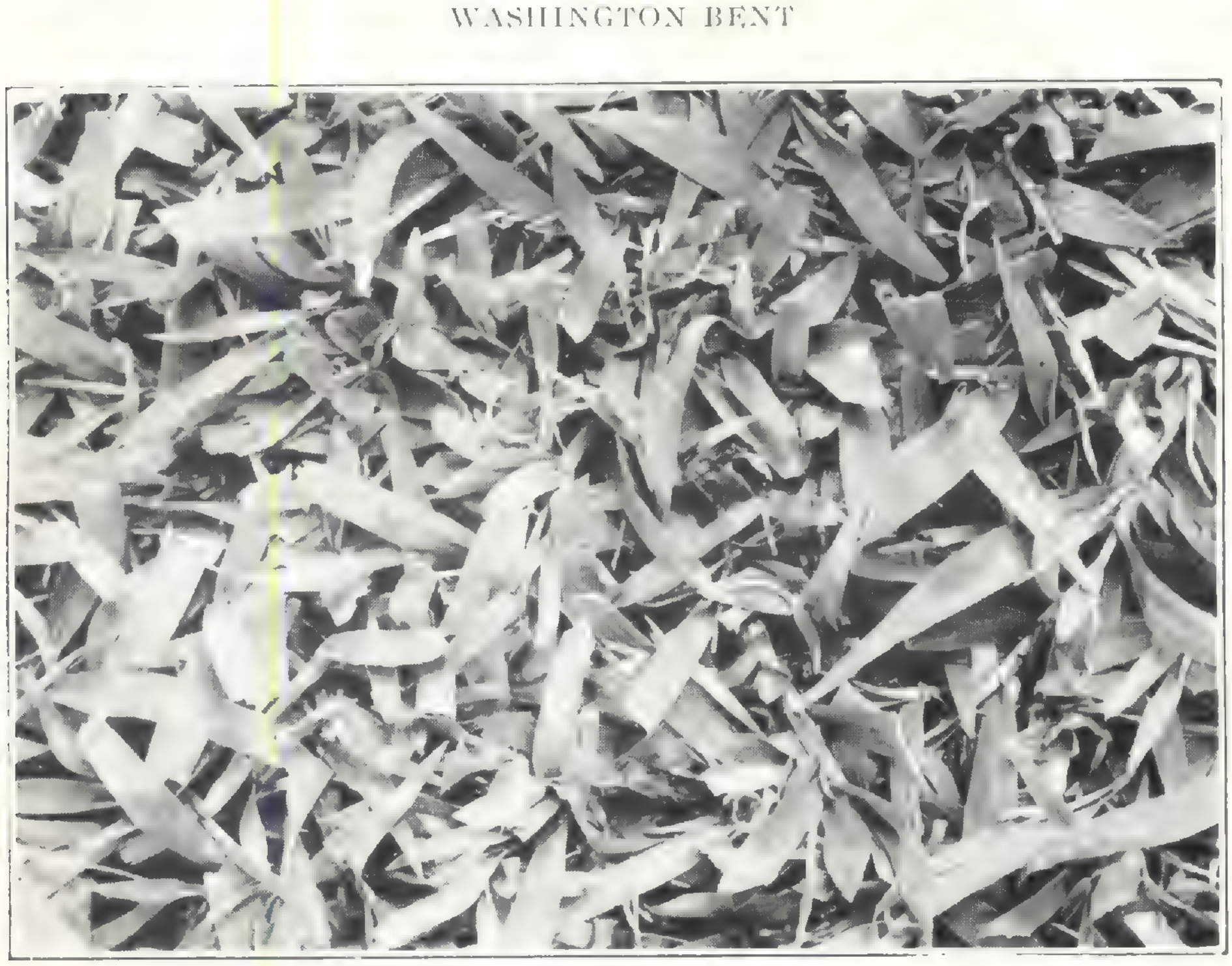
quently be found in St. Louis when they have been shaded during a part of the day by a tree or a building. At the Garden the outline of the shadow of a tree or shrubbery plantation is not infrequently marked by a beautiful patch of blue grass, whereas just beyond the shadow little or no blue grass can be found.

Because of the unsatisfactory results with blue grass and red top, the Garden undertook some years ago a series of experiments in the hope that possibly some more satisfactory lawn grass or combination of grasses might be obtained for St. Louis. It very soon became evident that certain of the so-called bent grasses were most promising, and, from our experience up to the present time, there seems to be no question but that one of the special strains of creeping bent comes nearer to answering the requirements of a grass for St. Louis lawns than any other.

What is creeping bent?—The term "bent" has been applied variously to different species of grass of the genus Agrostis. While there are a large number of species in this genus, only three or four are of any importance from the standpoint of lawn making. Red top (*Agrostis alba*), Rhode Island bent (*Agrostis tenuis*, sometimes called *A. vulgaris*), velvet or brown bent (*Agrostis canina*) are all species more or less closely related to the true creeping bent, namely, *Agrostis stolonifera*. The seed which comes to this country as "German bent" or "creeping bent" is more properly termed "South German mixed bent," since it usually contains two to three kinds of Agrostis, together with various other grass seed. Some of these mixtures may contain a large percentage of red top or velvet bent and only a negligible quantity, if any, of the true creeping bent. Consequently, the use of this mixture will not result in a lawn of pure creeping bent. As a matter of fact, there is very little seed of the true creeping bent on the market, and the only way to secure a satisfactory lawn of this grass is by the use of stolons or underground stems referred to later in this article. To complicate the matter further there are something like a hundred varieties of the true creeping bent. Mainly through the activities of the



WASHINGTON BENT



CRAB GRASS

LARGE SOD OF WASHINGTON BENT GRASS FROM THE EXPERIMENTAL GRASS NURSERY.

Greens Committee of the United States Golf Association, in co-operation with the Department of Agriculture, there have been selected from this great number of varieties three or four which, because of their freedom from disease, resistance to adverse weather conditions, and quality of turf, stand out as being the grasses best adapted for putting greens. It is these varieties which have been experimented with at the Garden in an effort to develop a suitable lawn grass.

Preparation for planting.—In order to create a lawn of creeping bent the ground must be thoroughly prepared. If grass is growing on the land it should be removed with a spade, taking part of the soil so as to eliminate as much of the old grass and weed seed as possible. After thoroughly working the soil it should be raked level, and if of heavy clay a light dressing of well-rotted stable manure, in the proportion of one cubic yard to a thousand square feet, may be incorporated in the upper six inches of the soil. The use of excessive amounts of stable manure should be avoided. In fact, the clay loam which abounds in this vicinity is well adapted for creeping bent, since one point in favor of this grass is its ability to thrive under conditions which would not permit the growth of blue grass and similar lawn grasses. The only fertilizer which should be used is ammonium sulphate. This chemical, applied at the rate of five pounds per thousand square feet before any planting is done, will assist in producing an acid condition of the soil.

Planting of stolons.—A stolon is a creeping stem possessing a series of joints from which new shoots and roots are developed. Creeping bent spreads by these jointed stems along the surface of the ground and differs from most grasses in having the ability to put out roots at these joints. Each joint, as it were, produces an independent plant. Chopped stolons of the Washington strain of creeping bent, as well as other strains, may be purchased from various nurseries in this country which now make a specialty of supplying this grass. One should be sure to deal with a reliable firm able to give every assurance of the genuineness of the strain. The stolons are shipped in bags ready for broadcasting over the prepared

ground. If these stolons have dried out in transit they should be soaked in water before spreading, and if hot weather is prevalent the ground should be well watered before broadcasting them. The pieces of creeping stem should be distributed as evenly as possible, and if immediate effects are desired there should be a piece for approximately every square inch of ground. This is at the rate of about one ten-quart bucket of chopped stolons to two hundred square feet of ground. They may be planted more sparingly than this, but much greater time is required to cover the area and a good deal more hand weeding will be necessary before the grass is thoroughly established.

As soon as the stolons are spread they should be immediately covered with screened soil. The object of this top dressing is not to bury the stolons, as one would a seed or root, but to hold the pieces in place and prevent their drying out. They would take root quickly and grow rapidly upon the surface of the soil without any covering whatsoever. Have portions of the stolons visible above the soil, since many of the shoots will not be strong enough to force their way through a considerable thickness. From one-fourth to three-eighths inch of top dressing will be sufficient if the soil is dropped on the top of the stolons and not thrown from the side so as to roll underneath them. After applying the top dressing the ground should be rolled and then watered. Watering with a fine spray is essential for the first two or three weeks, and until the roots are well established the ground should not be allowed to become dry.

Plugging.—A "plug" consists of one or more plants with their roots, obtained by dividing sod into pieces two or three inches in diameter. The sod should be cut much thicker than when cut for stolons in order to preserve as many roots as possible for planting. Holes six to eight inches apart should be dug with a trowel, and the plugs of sod planted in them, just as any other plant, afterward pressing the soil firmly about the plug. The photograph (pl. 44, fig. 2) was taken September 25, the date of plugging, and two months later the growth had practically covered the surface of the ground.

ROOTS AND STOLONS AFTER REMOVAL OF SOD FROM ONE-HALF THE AREA, WHICH, IF TOP-DRESSED, WILL DEVELOP INTO A NEW LAWN

BROADCASTING STOLONS

STOLONS READY FOR TOP-DRESSING

The above method has been used at the Garden in repairing bare spots in the lawns, and it has been found that the work can be done much later both in the spring and fall than with stolons, since one is using a plant with roots and not cuttings of stems. The latest test was made on November 17, and the success of this will depend upon whether the plants will root sufficiently to overcome upheaval due to repeated freezing and thawing during the winter.

The use of ammonium sulphate.—A peculiarity of creeping bent, as well as certain other bent grasses, is that it thrives in an acid soil rather than an alkaline one. Since most of the common lawn weeds will not grow in acid soil, a well-established lawn of creeping bent automatically eliminates one of the chief difficulties in keeping a presentable lawn. Most of the soils in the vicinity of St. Louis are either neutral or alkaline, and in order to get the best effect with creeping bent it is necessary to change the reaction of the soil to acid. This is most easily accomplished by the use of ammonium sulphate which acts as a fertilizer as well.

To determine just when the soil has reached the right degree of acidity is not always easy, since the simple test sometimes resorted to of blue litmus paper turning red is entirely too unreliable. The most accurate method and the one which should be used if ammonium sulphate is to be applied intelligently is the bromcresol purple test. Place about a teaspoonful of soil in a small jar and add to this about four teaspoonfuls of clear rain water or distilled water. Ordinary city water which is strongly alkaline should not be used for any purpose in this test; in fact, all the utensils must be carefully rinsed with rain water or distilled water before using. Shake the soil and water thoroughly and then allow to settle for several hours. Rinse a white porcelain dish with distilled or rain water, and into this put five or ten drops of the clear watery soil solution. This sample should be removed with a glass rod or tube which has been thoroughly rinsed. One ounce of a 1 per cent solution of bromcresol purple, which should be obtained from the drug store, is now added, a drop at a time, to the water solution in the porcelain dish. If a

clear bright yellow color results the soil is sufficiently acid to prevent the growth of common lawn weeds and at the same time is in the best condition for the creeping bent. Should the mixture assume a purplish or brownish color, however, the need for additional applications of ammonium sulphate is indicated.

It is not necessary that the proper acid condition of the soil be obtained before the stolons are planted, although, as indicated above, a fairly liberal application of ammonium sulphate at this time is an advantage. After the lawn is established an application of this chemical in the spring and fall is always beneficial and, aside from the fertilizing value, will tend to maintain the acid condition so necessary for perfect success. Ammonium sulphate should never be applied at a rate greater than five pounds per thousand square feet, and in hot dry weather its use should be discontinued. Experience would seem to show that there is little response from ammonium sulphate in the summer, and it is better not to attempt to use it at this time. The sulphate may be applied dry by simply sowing it over the ground, after which it may be washed in thoroughly by rain or the use of the garden hose. Such a method, however, is apt to result in very unequal distribution and may cause burning of the grass when the chemical is not thoroughly washed from the leaves. A much better way is to dissolve a pound of ammonium sulphate in ten gallons of water and apply this direct with a sprinkling can or any one of the various devices on the market for distributing fertilizer with a hose. Another very satisfactory method is to incorporate ammonium sulphate with the top dressing of the soil, at the rate of one pound of the chemical to ten pounds of the soil.

Diseases.—About fifteen years ago the so-called "brown patch" disease of creeping bent was first definitely recognized. Small brown spots, looking as though the grass had been scalded, appeared at irregular intervals and spread indefinitely. A cobweb-like growth can usually be detected upon the blades of grass. This is due to a fungus which attacks numerous species, to which, fortunately, the Washington and

ROLLING

WATERING

CUTTING STOLONS FOR BROADCASTING

PREPARING SOIL FOR TOP DRESSING STOLONS

Virginia strains of creeping bent are not nearly so susceptible as the other strains of this grass. This is one reason for being sure that the proper strain is obtained when buying stolons. Should the fungus appear, however, it can usually be controlled by the use of Bordeaux mixture. For the average individual the easiest way to apply this fungicide is to sprinkle the dry powder on the grass at the rate of one pound to 5000 square feet. The powder should lodge on the leaves and not on the roots; consequently it should be applied only when the dew is on the grass, or immediately after watering. A light top dressing of loam containing from one-half to one pound of ammonium sulphate to a thousand square feet, followed by immediate watering, is sometimes efficacious, and in mild attacks liberal watering in the morning is sufficient to destroy the fungus.

Another disease, known as "little brown patch," in contrast to the large brown patch above referred to, sometimes attacks creeping bent. These small patches, about the size of a dollar, do not enlarge but may occur so abundantly as to affect seriously the appearance of the lawn. This disease, the cause of which is not definitely known, does not respond to the Bordeaux treatment. The only remedy which seems to be effective is one of the mercuric compounds which are sold under the trade names of "Semisan," "Uspulum," and "Calogreen." These chemicals, dusted on at the rate of one pound to 6000 square feet, applied as soon as possible after the disease is discovered, usually produce the desired result. If a sprinkling method is preferred, one pound dissolved in fifty gallons of water, applied to 2000 square feet, followed by a light spray of water, may serve the purpose. Attention should be called to the fact that browning and discoloration produced by drought should not be mistaken for one or the other of the so-called "brown patch" diseases. Numerous cultures made from discolored patches appearing in the various tests carried on at the Garden have failed to reveal the fungus, and so far as the evidence goes there does not seem to have been an authenticated case of these diseases in any of the experimental plots or lawns thus far established.

Nematode worms have in a few instances proved to be responsible for the browning of the grass, but in most cases dry hot weather is the cause.

Experiments at the Garden.—In view of the importance of the lawn problem in the city of St. Louis a review of the various experiments carried on at the Garden may not be without interest. In 1918 the first experiments were started in two circles in the economic garden where twelve standard grass mixtures were sown in wedge-shaped plantings somewhat suggesting a wheel and later referred to as the "wheel of grasses" by visitors. The dominant grass in all the sections was the Kentucky blue, but a full account of the various mixtures with the purpose for which they were devised will be found in the Garden BULLETIN for April, 1918.

In 1922 experiments on a larger scale were started west of the economic garden between the row of trees in the test nut orchard. The following year the number of plots was increased to thirty-five, embracing practically all the lawn grasses and mixtures at all likely to succeed in this climate, and for the first two years they were given unusual care as regards weeding, watering, fertilizing, etc. This rather comprehensive test was decidedly in favor of the bent grasses, including creeping bent, Rhode Island bent, and colonial bent, the next best being the fescues. As a result, in 1924 this garden was abandoned for experiments with bent grass alone, the original thirty-five plots being left uncared for to await the survival of the fittest. For the past four years the only treatment of these plots has been the periodical cutting with a buck-eye mower. This fall a check of all the plots was made, and the only grasses still alive were: Plot 1, sheep fescue (very good); plot 3, hard fescue (very good); plot 4, red fescue (very good); plot 6, fine-leaved fescue (poor); plot 16, meadow grass (good); plot 18, German creeping bent (very good); plot 19, colonial bent (very good); plot 22, Kentucky blue (very good). All of the others were dead, including fescue, orchard grass, meadow foxtail, sweet vernal, rough-stalked meadow grass, Bermuda grass, Canada blue, red top,

TOP-DRESSING STOLONS

PLUGGING

Italian rye, Paccy's rye, crested dog's tail, white clover, and seven separate special lawn grass mixtures.

This test, covering a period of from five to six years, suggests first, that ordinary grass mixtures are of short duration within the city. Second, that the various fescues stand up remarkably well, forming solid plots of green sod. Unfortunately, however, these grasses cannot be recommended for lawns because their tufted habit of growth produces such an uneven surface. Third, that the bent grasses, including creeping bent, colonial bent, and Rhode Island bent, stand out above all others tried as producing the best lawn under city conditions. It is interesting to note that Kentucky blue grass when allowed to go to seed and grow to a length which shades the young growth produces a fine sod, whereas all the other blue grass in the mixed plots disappeared, thus demonstrating what is a common observation—that the grass will thrive in St. Louis under partial shade and if not cut too often or too close.

The outstanding success of the bent grasses suggested further trials as a lawn grass. For this purpose the circle between the old Shaw residence and the mausoleum was selected. On October 9, 1924 (see September, 1925, BULLETIN), the ground was cleared of all existing sod and thoroughly spaded one foot deep. Stolons of Washington bent were then broadcast, using three bushels for an area of 2000 square feet. By the spring of 1925 the entire plot was well covered with young grass and by June a perfect sod was formed. In the latter part of June, what was thought to be brown patch appeared but the trouble soon proved to be due to army worms which were quickly eradicated by spraying with a solution of Paris green. After recovery from this attack the lawn remained so satisfactory throughout the summer that it was decided to plant with Washington bent the entire area between the main gate and the large conservatories. This was accomplished during the latter part of September and early October, 1925, the supply of stolons being obtained from the old residence circle. After planting this area there were still enough stolons to plant a thousand square feet in the

nursery. The average quantity of stolons for broadcasting was one square foot of chopped sod to forty square feet of area. In May, 1927, the city was visited by a most destructive hailstorm which wrecked the greenhouses and caused much damage at the Garden. All available Garden help was required for reconstruction, and consequently very little attention could be given to the new bent-grass lawn. In spite of this very good results were obtained the first year. Occasional patches of dead grass caused by crab grass appeared in the fall, but these spots were replanted by plugging. The past season of 1928 the lawn was kept as free as possible from crab grass and watered during dry weather. It is without doubt the best lawn area in the Garden and has attracted attention throughout the entire summer and fall.

In June, 1927 (November, 1927, BULLETIN), an experiment to determine the ability of bent grass to crowd out crab grass was started in the nursery. For this test a crab grass-infested area 75x75 feet was selected from which only the large weeds were removed. Small pieces of bent grass sod were plugged into the plot, very little subsequent attention being given. At first, weeding was attempted but this was soon abandoned as useless. In August the test seemed a failure, since to all appearances the "lawn" was 100 per cent crab grass. After the first frost, however, the bright green color of the bent began to show itself, and during September all bare spots were again plugged with bent. By the following spring the entire area was covered with an almost perfect sod of bent grass and after a summer weeding the bent practically eliminated the crab grass. No plugging was necessary this fall.

In September, 1927, further experiments were started in the nursery (November, 1927, BULLETIN) from grasses received from the United States Department of Agriculture. The first shipment, on December 19, included sod of Highland Velvet bent, Metropolitan bent, Washington bent, and Virginia bent. These were immediately planted in prepared plots 10x100 feet, with the exception of the Highland Velvet bent which is an extremely fine-leaved grass; this was sown

in a plot 1x20 feet. On September 21 seeds of the following grasses were received and planted in the same-sized plots: Kentucky blue grass, red top, South German bent, Rhode Island bent, and creeping fescue. The four vegetative bents developed rapidly, and during December all the plots showed a uniform green surface, indicating good growth of both stolons and seed. During January repeated freezing and thawing had a disastrous effect upon the seed grasses but there was no indication of damage to the vegetative bent. By April all the vegetative bents showed 100 per cent sod except the fine-leaved Highland Velvet bent, of which 75 per cent was water-killed. The seed grasses showed: creeping fescue 30 per cent dead, Rhode Island bent 40 per cent dead, South German bent 50 per cent dead, red top 100 per cent dead, Kentucky blue grass 100 per cent dead.

These beds were again prepared and sown with seed during April. Throughout the summer all plots were given the same attention as to weeding, watering, edging, etc. This fall all the plots sown with seed were heavily infested with crab grass and assumed the well-known appearance of the average St. Louis lawn.

The Virginia strain of bent stood out as the best for lawn purposes, with the Highland Velvet bent the poorest. The latter, because of its slow growth, tufted habit, and being subject to winter killing, should never be used, at least in St. Louis. All of the vegetative bents, however, remained free from crab grass.

The total grass area in creeping bent in the main garden and nursery now aggregates almost three acres, all of which was propagated from the original three bushels of stolons received and planted in October, 1924. An interesting fact worthy of note is that the removal of a bent sod averaging one inch in thickness does not necessarily mean total elimination of this grass. Frequently the subterranean roots and stolons remain and immediately start to grow. If lightly top-dressed after cutting a good bent sod may ultimately develop from the bits left in the ground. This has been proved both

in the nursery and in the original planting opposite the old residence.

The most critical period for bent-grass lawns is during the extended dry spells in July and August. At this time (as with the blue grass lawns) it is necessary to water thoroughly in order to maintain a greensward. During August, 1927, a section 20x20 feet in the nursery showed browning, but examination proved that the stolons were green. The area was given a very light top dressing with decomposed tea leaves and then thoroughly soaked. Within two weeks the ground had the appearance of a lawn freshly broadcast with cut stolons, and four weeks later a perfect sod had formed. The following summer (1928) this area was the best in the Garden. Similar results were obtained at Gray Summit Extension where a test plot of some 1500 square feet was established. In August, 1927, considerable burning was evident, which was to be expected as no watering whatsoever was done throughout the summer. Here all top dressing had to be dispensed with, but despite this lack of attention the stolons made sufficient growth to produce a perfect sod the following spring. During the past year, due to frequent rains, less discoloration was observed, and at the present time this patch stands out as the best lawn on the place.

Still another test was started in September, 1927, on the south lawn of the Superintendent's residence, at Magnolia and Alfred Avenues, the Virginia, Metropolitan, and Washington strains being used. The only care given was cutting once a week and watering twice during the summer. Few discolorations or burnt spots occurred and at the present time these have disappeared. Of the three strains the Virginia bent stands out as the best, with the Metropolitan the least desirable. Contrary to the directions recommended for putting greens, which call for several top dressings throughout the year, bent grass for lawn purposes needs no such treatment. The lawn at the Garden receives only a light dressing in December of decomposed tea leaves. Experience seems to prove that the expense of top dressing lawns is not necessary, except of course for burnt areas and at the time of broad-

casting stolons. Further, by not top dressing one reduces the danger of sowing crab-grass seed which is present in all St. Louis soil whether composted or otherwise. Soil piles at the Garden show crab-grass seed present several years after composting.

Subsequent care.—September is the best time to establish a lawn of creeping bent in St. Louis. If the ground is prepared and planted by September 15 a good growth sufficient to withstand the alternate freezing and thawing during the winter will have been established by the middle of November. By the following May the stolons will have produced a mat solid enough to inhibit growth of a large percentage of the annual grasses. During January a light winter mulch is beneficial, using either decomposed tea leaves, rotted leaves in the form of leaf soil, or well-rotted stable manure. No top dressing other than a winter mulch has been given to any of the bent grass lawns or test plots in the Garden.

The greatest growth of bent grass occurs in spring and fall, and at this time the lawn will need cutting twice as often as a blue grass lawn. During the summer exactly the reverse is true. As the creeping bent becomes established it will form a sod thick enough to overcome the growth of dandelions, plantains, chickweed, and to a lesser degree knotweed and crab grass. The first year after planting some annual grasses may be expected, since it is impossible to eliminate the seed left in the soil from the previous season. Even where crab grass appears it will be superimposed upon the bent, making removal easy by hand pulling, especially if a knife is used to cut the rooted center. The elimination of the annual grasses the first season is an important factor in the future success of a bent-grass lawn and should be started in early June.

According to the experiments at the Garden there are numerous advantages of the Virginia or Washington strain of creeping bent over any other lawn grass tried for St. Louis. Not only will this grass, when properly treated, withstand satisfactorily the St. Louis summers, but when established in the fall it will better withstand the alternate freezing and thawing of the winter than seeded lawns. The ability of bent

grass to thrive in an acid soil which is unfavorable to dandelion, plantain, and chickweed, and to hold in check the annual grasses, has frequently been pointed out. On the other hand, the treatment recommended for a blue-grass or red-top lawn is unfortunately beneficial for the growth of lawn weeds as well.

As was stated in the February, 1925, BULLETIN, in an article on "Feeding of plants with special reference to lawns": "No stand of grass worthy of the name lawn can be obtained without the expenditure of care and money, and after being once established it cannot be neglected any more than a flower or vegetable garden." If one is willing to follow the directions given and take the trouble to meet the requirements of the plants used for a lawn, it is believed that a greater degree of success can be obtained in this vicinity by the use of creeping bent than any other grass known at the present time.

CONCLUSIONS

Top dressing, other than a light winter mulch, is not necessary.

The more a lawn is top-dressed with soil or compost, the greater the danger of infesting it with annual grasses.

Cut bent grass no closer than blue grass. The closer bent grass is cut the greater the possibility of discoloration during dry weather. Remember it is a *lawn* not a *putting green* that is being made.

Water thoroughly in dry weather. Bent grass does not root as deeply as blue grass, and will discolor or burn during drought sooner than blue grass.

Start stolons in the fall. It is desirable to have good sod before spring so as to choke out the young plants of annual grasses. Remember stolons are the green unrooted pieces of stems and will soon die unless kept moist.

When applying ammonium sulphate, be sure to water immediately so as to avoid burning. Or better, apply in solution, one pound to ten gallons of water. Application other than spring and fall is unnecessary.

The beginner should become acquainted with the care and culture of bent grass before undertaking too large a planting.

Purchase a small amount of stolons or sod the first season, enough to plant a small area. By the next season this will develop sufficiently to plant a much larger area.

There are various bent-grass seeds sold by the seedsmen. Remember the vegetative bents rarely produce seed, and this is not generally on the market. Purchase stolons or sod of the Virginia or Washington strains for St. Louis lawns.

NOTES.

Dr. D. T. MacDougal, Director of the Desert Laboratory, Carnegie Institution of Washington, Tucson, Arizona, visited the Garden, December 5.

The pupils of the Bryan-Mullanphy School decorated a holly tree in the Garden with all kinds of bird food as a Christmas tree for the birds.

Mr. G. H. Pring, Superintendent of the Garden, gave a talk, illustrated with lantern slides, on "Orchid Exploration," before the Men's Club of the Florissant Methodist Church, December 20.

Mr. L. P. Jensen, Arboriculturist to the Garden, spoke before the faculty of the St. Louis University Medical College, November 23, on "The Missouri Botanical Garden Extension"; before the Osage Hills Garden Club, November 24, on "Lawns and Ornamental Plantations"; and before the St. Louis Horticultural Society, December 7, on "Winter Gardening."

Dr. George T. Moore, Director of the Garden, has given the following talks recently: November 27, before the Garden Club of St. Louis, on "The Most Unique Garden in England"; December 3, before the Current Topics Club, "Morality in Plants"; December 10, at the St. Louis Country Day School, "The Plant Commonwealth"; December 12, at the annual dinner of the Phi Sigma Biological Society, "Newspaper Science."

At the close of the annual chrysanthemum show, the flowers were distributed by the Book and Flower Guild to the following institutions: Memorial Home, Bethesda Home and Hospital, City Infirmary, Missouri Pacific Hospital, Central In-

stitute for the Deaf and Dumb, Shriners' Hospital for Crippled Children, Good Samaritan Altenheim, McLain Orthopedic Sanitarium, Masonic Home, Christian Hospital, Mt. St. Rose Hospital, Veterans' Hospital, Jefferson Barracks, Home of the Friendless, Kirkwood Old People's Home, Kingdom House, Park View Old People's Home, Missouri Home Society, Altenheim, Little Sisters of the Poor.

The poinsettia show, which has occupied the Floral Display House since the first week in December, is larger than ever before and has been provided with an appropriate setting. Since poinsettias came originally from Mexico, the entire Floral Display House has been transformed into a Mexican court yard. Rough plaster walls and arched gateways inclose a central patio where the main display is staged in small beds. A wall fountain, set among palms, completes the picture, and the whole forms a perfect setting for the brilliant flowers. The response of the public has been gratifying, and very complimentary notices have appeared in the St. Louis papers. The exhibit will remain in place until after the holidays, when it will be replaced by the annual orchid show.

STATISTICAL INFORMATION FOR NOVEMBER, 1928

GARDEN ATTENDANCE:

Total number of visitors	67,578

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	29
Total number of books and pamphlets donated	318

PLANT DISTRIBUTION:

Total number of plants and seed packets donated	15

HERBARIUM ACCESSIONS:

By Purchase—	
Smith, Dr. H. R.—Specimens of *Laboulbenia formicarium* Thaxter	2
Thompson, J. W.—Plants of Oregon	2,000
By Gift—	
Dougan, Prof. L. M.—*Verbesinia virginica* L. from Meramec State Park, Missouri	1
Pring, George H.—Plants of horticulture	2
By Field Work—	
Kellogg, John H.—Plants of Missouri	201
Total	2,206

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Vandeventer avenue car line (No. 33). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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